the

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CORRECTIVE THERAPY

JULY-AUGUST, 1959

VOL. 13 NO. 4

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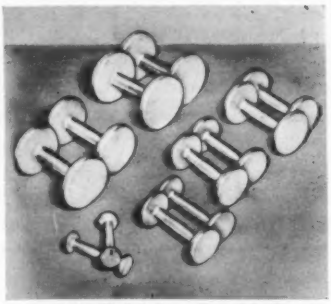

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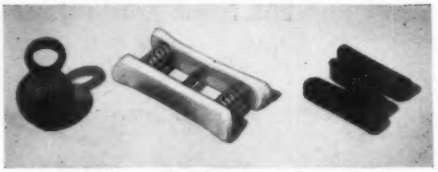

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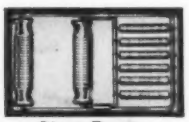

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FATIGUE AND PHYSICAL FITNESS*

D. B. DILL**

Introduction

Fatigue is a common effect of exercise. It is always experienced after exhausting exercise. Yet, we all know that the fatigue caused by a 60-meter dash differs greatly from that caused by a 10-mile walk. Hence, instead of trying to describe in general terms the nature of fatigue, it is much simpler to describe the specific manifestations of fatigue in exercise of short and long duration and of high, medium, and low intensity. We shall see at least one characteristic in common: a disturbance in balance between wear and repair.

It may help to understand the varying nature of fatigue by refering to a concept used in toxicology, that of Ct. In this expression, C is the concentration of the toxic vapor and t is the duration of exposure. The product Ct is constant or nearly so for a wide range of concentration and of duration of exposure. For example, if we double the concentration and halve the duration of exposure, the toxic effect will be the same. The same concept can be applied, in a rough non-quantitative sense, to muscular work: the capacity for work and the fatigue induced by it are related to its intensity and duration. At one extreme is the 60-meter dash lasting about five seconds and at the other, a day's labor in heavy industry which, with overtime, may last for twelve hours. In the first example, the work is accomplished with the reserves of oxygen in the blood and lungs plus the body's resources of anaerobic energy. In the second, the work must be entirely aerobic. Between these two extremes are found activities in which the energy is supplied partly by aerobic, partly by anaerobic reaction. In simpler terms, work of longer duration depends on the oxidation of carbohydrate or fat while intense work of short duration can be accomplished without oxidative reactions; these take place during recovery.

Fatigue In Exhausting Exercise of Short Duration

Maximal Rate of Energy Output

In bursts of all-out exercise, man reaches his maximal rate of energy output within a few seconds and can maintain this rate for 20 or 30 seconds. Thereafter, the rate falls off. As will be seen in Table I, based on records published in the *World Almanac* (3) the rate in the fastest 200-meter run is 9.90 meters per second and in the 400-meter run, 8.73 meters per second.

Why is it impossible even for a champion to run further than 200 or 300 meters at 9.90 meters per second? There is no simple, complete explanation, but this much is well-known: when the store of chemical energy that can be transformed without oxygen is exhausted, muscles come to a standstill. But there is more to the explanation than this: a large number of facts must be taken into account. The phenomenon of tetanic contraction seen in isolated nerve muscle preparations is characterized by a period of sustained performance that may last for minutes or even hours depending on the frequency of stimulation. Eventually, performance begins to decline but does not fall to zero for some time. Carrying over these observations to the case of the champion sprinter, we can assume that he reaches the point of decreasing performance in about 20 to 30 seconds. He has not exhausted his reserves of anaerobic energy, but he has reached the limit beyond which these reserves cannot be transformed into mechanical energy at the peak rate.

Running Records For Man

distance (meters)	record min.	record sec.	rate min./sec.
60		6.6	9.09
100		10.2	9.80
200		20.2	9.90
400		45.8	8.73
800	1	46.6	7.52
1,500	3	41.8	6.76
2,000	5	7.0	6.51
5,000	13	51.2	6.02
10,000	28	54.2	5.77
15,000	44	54.6	5.57
20,000	59	51.7	5.57
25,000	79	11.8	5.26
30,000	95	23.8	5.24

* As published in the World Almanac, 1956(3). The 60-meter record was established indoors; all others are outdoor runs.

Table I

Lessons From Comparative Physiology

Physiologists have learned much about exercise in man by comparisons of the capabilities and performances of other species. Man is slow as compared with some of his four-legged friends—notably the dog and the horse. These four-legged runners can run much faster than man. The greyhound, for example, can run for 400 meters at 16.6 meters per second, two-thirds faster than man's top speed in the 200-meter

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race. While a full explanation cannot be given, the greyhound has the following advantages:

- The effort is divided between four legs: a larger fraction of the body is engaged in useful work than in man.
- The greyhound's body is parallel to the ground and hence the resistance offered by air is less per unit of body weight than in man.
- The greyhound, per unit of body weight, has a larger heart and larger blood volume than man: on this account, his capacity for transporting oxygen is greater than man's.
- The heart rate of the greyhound can increase from 60 to 300, a factor of 5. Man can increase his from 60 to 180, a factor of 3. The relative abilities to increase cardiac output probably are in the same proportion.

Fundamentally, the chemical reactions involved in muscular exercise are much the same in dogs as in man; the differences are anatomical and functional, not biochemical. For example, in both dog and man, lactic acid reaches high levels in intense exercise of short duration.

Lactic Acid

What is the significance of the accumulation of lactic acid in bursts of all-out exercise? Years ago, lactic acid accumulation was thought to be an index to fatigue with recovery going hand-in-hand with removal of lactic acid. We now realize that recovery is more complicated than this. For one thing, it appears that the oxygen debt contracted during anaerobic work is repaid by two processes. One of these is rapid and does not involve the removal of lactic acid. The other, involving removal of lactic acid, is much slower. Margaria and associates (20) have called these components the alactacid and the lactacid debts, respectively. It was concluded from their work that the alactacid debt is incurred in all forms of exercise and that in a man of ordinary size it can reach a level equivalent to 2.5 liters of oxygen. No lactacid debt is incurred in light or even moderate exercise. In walking or running, for example, the metabolic rate may be increased four or five times before any lactacid debt is incurred. These conclusions are summarized in Fig. 1, based on a large series of observations on a distance runner weighing about 65 kg. He ran for from seven to ten minutes at various rates and grades.

The same figure shows that the lactacid debt was directly proportional to the oxygen consumption attained. The lactacid debt was contracted after the oxygen consumption reached about 2.5 liters per minute, or two-thirds of his maximum rate of oxygen consumption. His lactacid debt increased rapidly as

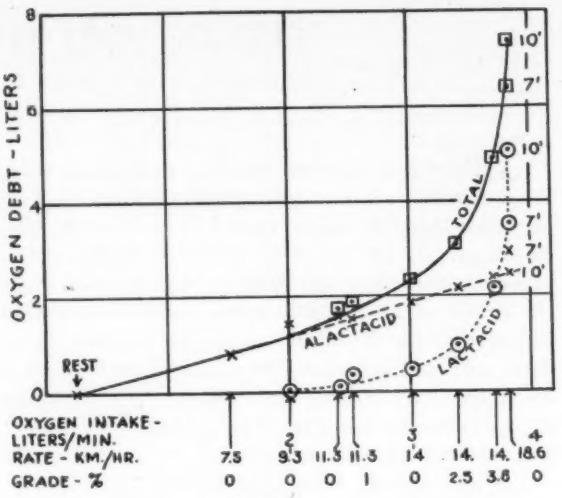


FIG. 1

Alactacid and lactacid debts after exercise varying in intensity and duration. In this trained runner the size of the alactacid debt is proportional to the oxygen intake and amounts to about 2.5 liters at the highest level of exercise. There is no accumulation of lactic acid until the oxygen intake reaches 2 liters per minute. The maximum lactacid debt is about 5 liters.

his rate of oxygen consumption approached his maximum attainable value, 3.8 liters per minute.

Studies of the rate of movement of lactic acid in and out of red cells have thrown new light on the process of contracting and paying the oxygen debt. In the first approach made to this problem by Dill and associates (13) a man ran to exhaustion in 40 seconds on the treadmill and then jumped into a cot. As quickly as possible, usually within 10-15 seconds of the end of work, the first of a series of samples of blood was drawn from his femoral vein. By leaving the needle in the vein and changing syringes, additional samples were taken every 15 seconds during the first two minutes and less often during the next ten minutes. Each sample was cooled in ice; within 20 seconds, its temperature could be lowered almost to the freezing point. For the first five minutes, the concentration of lactate in plasma remained constant. The concentration in red cells and hence in whole blood rose during this period. These results made it evident that lactate diffuses slowly from plasma into red cells. Since at the end of the 40-second run the concentration of lactate in the extracellular fluid bathing muscle cells must have been at least as high as the observed concentration in plasma, it follows that in the early stages of recovery the total muscle lactate may be higher than is predicted from the concentration of lactate measured in whole blood.

This observation and deduction led Johnson, Edwards, Dill and Wilson (18) to study the rate of movement of lactate from plasma into red cells *in vitro*.

Venous blood was drawn into a tube containing heparin and cooled to about 4°C. The plasma, separated by centrifuging, was drawn into another tube under oil and enough lactic acid was added to bring the concentration near that found after severe exercise. The plasma with admixed lactate was then brought to the temperature of the cells and rapid mixing was effected: this was completed in less than 20 seconds. Portions of the mixed sample were drawn off from time to time and rapidly cooled to the freezing point after which cells and plasma were separated by centrifugation. Analyses of the plasma and of the mixed whole blood were carried out for lactate, chloride, bicarbonate and other components. The results revealed that at 37°C about 10 minutes elapse before an equilibrium is reached in the movement of lactate from plasma into red cells. The equilibrium is half attained after two minutes. This fits in with the earlier measurements of lactate distribution between cells and plasma *in vivo* during the first few minutes after a short bout of exhausting exercise.

These observations on man and on human blood have not received much attention from comparative physiologists. It would be interesting to study these phenomena in animals, including poikilotherms. Is lactate equally slow in attaining equilibrium between the red cells and plasma of other mammals and of other classes of animals? Is there any lag in the movement of lactate from muscle cells into extracellular fluid? The advantage of using poikilotherms is that exercise could be carried out at low temperature; the experimenter would thus have more time to measure the rate of diffusion of lactate. That the anaerobic production of lactate occurs in strenously exercising fishes has been demonstrated by Black (7). Six species exercised 15 minutes at 11.5° to 12°C had blood lactates ranging from 4 milliequivalents per liter in the northern black catfish to 13 in the chub. In a large crocodile some hours after capture, Dill and Edwards (10) found that the blood lactate reached 22 milliequivalents per liter.

Summary: Exhausting Work of Short Duration

Some of the outstanding features of the fatigue resulting from all-out exercise lasting one minute or less are as follows:

- The source of energy is chiefly anaerobic.
- The oxygen debt is a measure of the anaerobic energy transformed.
- The oxygen debt is incurred in two forms—alactacid and lactacid.
- The alactacid debt is paid in a few minutes.
- The lactacid debt is paid about 1/20th as fast the time required is about 1½ hours.
- There is also an increase in the resting oxygen consumption; this is not a debt in the ordinary sense of the word.
- Diffusion of lactate is rapid from the tissue cells producing it into blood plasma and from thence to less active muscles; it moves slowly into and out of red blood cells.

Fatigue of Exhausting Exercise in Which Energy Expenditure Is Only Partially Anaerobic

We have seen that the athlete who excels in sprints can maintain maximum speed for 200 meters, but not for 400 meters. The record rate falls off from 9.90m./sec. in the 200 meter race to 6.02 in the 5,000 meter race. This transition phase extends from the sprints, which are largely anaerobic, to the distance runs, which are almost wholly aerobic.

How much energy can the athletic champion transform per second? We have seen that the maximum oxygen debt for a man of ordinary size is about 8 liters of oxygen. Such a debt, if contracted in a 200 meter run lasting 20 seconds, amounts to 400 ml./sec. when expressed in equivalent oxygen consumption. If the runner warms up, his oxygen intake may average 3.0 liters per minute or 50 ml./sec. during the race. Based on these assumptions, the rates of energy transformation during the race expressed in equivalent oxygen consumption are as follows:

Total	450 ml./sec.	100%
Aerobic	50 ml./sec.	11%
Anaerobic	400 ml./sec.	89%

The athlete who excels in running long distances can attain an unusually high rate of oxygen consumption. Several investigators, *e.g.*, Robinson, Edwards, and Dill (25), have reported values in excess of 5 liters of oxygen per minute. On 23 October 1954, Vladimir Kuc of the U.S.S.R. established a world's record in the 5,000 meter run of 13 min. 51.2 seconds (3). Let us assume that he ended with an oxygen debt of 8 liters and that his mean oxygen consumption during the race was 5.4 l./min. Based on these assumptions, the rates of energy transformation during that record run were as follows:

Total	100 ml./sec.	100%
Aerobic	90 ml./sec.	90%
Anaerobic	10 ml./sec.	10%

While the above estimates are approximate, they give us a good idea of the contrast in sources of ener-

gy under these two conditions: in a 20-second race, the source is 8/9th aerobic, while in the long distance run, it is 9/10th aerobic. The assumptions supporting the above calculations are based on incomplete data. We do not know, for example, the total oxygen debt contracted by champion sprinters and runners in their peak performances. This problem deserves further study.

What difference is there between the fatigue experienced when exhaustion is reached in 20 seconds and the fatigue of a 10- or 15- minute race? In the short race, little of the lactic acid produced in the working muscles has time to reach the blood stream; after the race is over, blood lactate continues to rise for several minutes. In the long race, there is time for the lactic acid to move to all tissues and so the total amount accumulated may be larger than in the short race. The rates of oxygen consumption and of carbon dioxide production have been at their highest levels during the race as is true also of the heart rate and cardiac output. Economy of effort is of major importance in the longer run while great power is essential to success in the dashes. If the long run is finished with a sprint, the picture of fatigue may be like that seen in the dashes.

Quantitative differences also can be seen in recovery. The greatest lactacid and alactacid debts are apt to be seen in races of five or ten minutes duration. By the time these debts are paid, the resting level of oxygen consumption is attained after dashes, but not after long runs. As pointed out previously, after long periods of exercise, even when the lactacid and alactacid debts have been paid, the level of oxygen consumption sometimes is elevated for hours. It seems that there is more wear and tear of body tissues in the long races — extra oxygen is required for restoring body tissue and reversing the processes of wear and tear.

Aerobic Work

The Fuels Used.

What fuels, *i.e.*, what proportions of fat, carbohydrate, and protein, are used in aerobic work? What relations exist between the reserves of these fuels and work performance? Is there a preferred fuel in aerobic work? Is there a limit to the rate of mobilization and utilization of the available fuels other than that set by the supply of oxygen? And what light is cast on the phenomenon of *fatigue* by the answers to these questions?

First of all, protein as a fuel can be eliminated from consideration. This is the only one of the three fuels containing nitrogen. Carbohydrate and fat contain no nitrogen while all proteins contain about 16% nitrogen. Since nearly all this nitrogen is eliminated in the urine, analysis of 24-hour urine samples gives a measure of protein metabolism. Physiologists long ago found that the amount of nitrogen excreted, chiefly as urea, depends on the protein intake and has almost no relation to the amount of exercise.

The fuels of aerobic muscular activity must be, therefore, carbohydrate, fat, or a mixture of them. The combustion of fat, whether in the body or the calorimeter, is associated with a ratio of carbon dioxide produced to oxygen used of 0.7. The corresponding ratio for carbohydrate is 1.0. When combustion occurs in the body, the ratio of carbon dioxide produced to oxygen used is called the respiratory quotient (R.Q.). Its value is ascertained by collection and analysis of expired air. Expired air collected while lactic acid is accumulating has an R.Q. above that corresponding to fuel oxidation and the R.Q. is correspondingly low in air collected while lactic acid is being removed. Hence, in order to interpret directly the R.Q. in terms of used fuels, it is best to determine it when a steady state has been attained in respect to lactic acid level. Under these circumstances, it is found that the R.Q. in easy work is about 0.8, *i.e.*, the same as in rest. As the intensity of the work increases, the R.Q. approaches unity. In other words, carbohydrate is the preferred fuel of strenuous muscular activity.

Work Performance and the Fuels Used.

The relation between the reserves of fat and of carbohydrate and work performance has been demonstrated in exercise experiments in man and in dogs. Balke and his asosciates (4) have found that in work calling for about 3/4ths the maximum attainable oxygen consumption, exhaustion is reached in from 30 to 60 minutes. Lactic acid does not reach a high level, but blood sugar drops. He interprets his experiments as proof that fat cannot be mobilized fast enough for such work and that exhaustion depends on the depletion of available carbohydrate. At lower intensities of work, Dill, Edwards, and De Meio (11) have found that fat can be mobilized and work can be continued after the R.Q. has dropped to 0.73, at which level the fuel is 90% fat. In one such experiment, we observed the R.Q. and blood sugar during a period of 24 hours, including four bouts of work, each lasting two hours. The subject began in the fasting state and had nothing to eat until the experiment was concluded. The mean R.Q.'s in the successive four work periods were 0.84, 0.79, 0.78, and 0.73. We also were interested in learning to what extent the injection of adrenalin influences carbohydrate utilization. The results, shown in Table 2 and illus-

INFLUENCE OF ADRENALIN ON CARBOHYDRATE UTILIZATION

Experiment	Carbohydrate Used, G. In each 2 hr., work period			total
	I.	II.	III.	IV.	
I.) Control	87	70	68	21	246
III.) Control	92	67	57	21	237
IV.) Control	93	61	51	15	220
Mean of controls	91	66	58	19	234
II.) Adrenalin	96	107*	107*	37*	346
Increment in carbohydrate used		41	49	18	
V.) Adrenalin	88	98*	97*	32	315
Increment in carbohydrate used		32	39		
VI.) Adrenalin	97	74**	72**	29*	262
Increment in carbohydrate used		8	14	10	
VII.) 100 g. glucose each period	122	126	116	93	457

*) Adrenalin intramuscularly, 1 mg. after ½ hour of work.
**) Adrenalin intramuscularly, 0.5 mg. after ½ hour of work.

TABLE II

trated in Fig. 2, proved that adrenalin increased the rate of utilization of carbohydrate and resulted in a total utilization in the work periods of from 262 to 346 g. as compared with 220 to 246 g. in the control experiments. In another type of experiment, Christensen(8) has shown that when the carbohydrate intake is high, the capacity for work performance on the bicycle ergometer is appreciably greater than when the cyclist is on a low carbohydrate diet. When his subjects were on a high carbohydrate diet, work of a grade which could be continued as long as 4 hours ended with a breakdown because of stiff and sore joints. On a high fat diet with other conditions unchanged exhaustion forced a halt after 90 minutes' of work. Hypoglycemia and subjective sensations indicated that the demand for carbohydrate had become acute. The administration of glucose brought relief promptly; within a few minutes the subject was able to resume work.

Work Performance of Dogs

Observations on the capacity of dogs for running on the treadmill bear out the same principles. Our dog Joe, for nine years an active member of the staff of the Fatigue Laboratory, loved to run on our motor-driven treadmill. If it was started when he was within hearing, he rushed to it, jumped on, and ran until exhausted. In one series of experiments reported by Dill, Edwards and Talbott (12), the run began either after a 36 hours' fast or 1 hour after a heavy carbohydrate meal. In the first case, no food was given and exercise was carried on to exhaustion; in the second case, fuel in the form of a glucose-sucrose candy was supplied at intervals. In each case, the schedule called for 25-minute runs with intervening periods of 5 minutes for drawing blood, observing rectal temperature, supplying water, and in some cases, fuel. The dog ran 50 minutes of each hour, putting out in each of these experiments 142 kilogram-meters (kg-m.) of energy per kilogram (kg) of body weight per minute.

The energy output has been calculated from the data of Slowstoff (26). He found that the energy requirement for running on an inclined treadmill may be resolved into horizontal and vertical com-

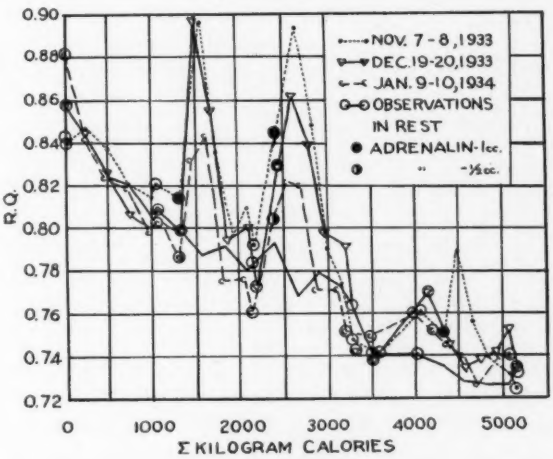


FIG. 2

Respiratory quotient (R.Q.) in relation to adrenalin injections in a trained athlete. In all experiments periods of rest alternated with work as follows:

Rest	1.5 hours
Work	2.0 hours
Rest	1.0 hours
Work	2.0 hours
Rest	1.0 hours
Work	2.0 hours
Rest	11.5 hours
Work	2.0 hours
Rest	1.0 hours

The heavy line represents control experiments. During the expenditure of 5000 calories of reserve energy the R.Q. in work drops to about 0.73. In the early work periods the increase in R.Q. after adrenalin is large; in the final work period, small.

TIME (hr.)	REMARKS	TEMPERATURE		INTAKE		BLOOD SUGAR
		Room (°C.)	Rectal (°C.)	Water ml.	Fuel g.	mg./100 ml.
0	Start	15.5	38.7	—	—	—
0- 1	——	15.0	39.5	340	40	—
1- 2	——	14.7	39.5	250	40	112
2- 3	——	15.5	39.6	180	40	131
3- 4	——	15.8	39.7	330	40	—
4- 5	Defecated	16.0	39.6	270	40	127
5- 6	Refused candy	15.6	39.9	270	0	132
6- 7	Urinated	14.8	39.8	120	40	—
7- 8	Defecated	14.8	39.8	30	40	120
8- 9	——	14.0	39.7	180	20	111
9-10	——	12.9	39.6	50	20	—
10-11	——	15.7	40.0	105	20	107
11-12	Refused candy	14.4	39.6	215	0	—
12-13	Refused candy	13.6	40.0	100	0	103
13-14	Glucose by stomach tube	13.6	39.8	295	42	—
14-15	Glucose by stomach tube	13.4	39.7	355	50	94
15-16	Refused candy	14.0	39.7	100	0	—
16-17	Tired but not exhausted	13.7	39.5	100	0	101

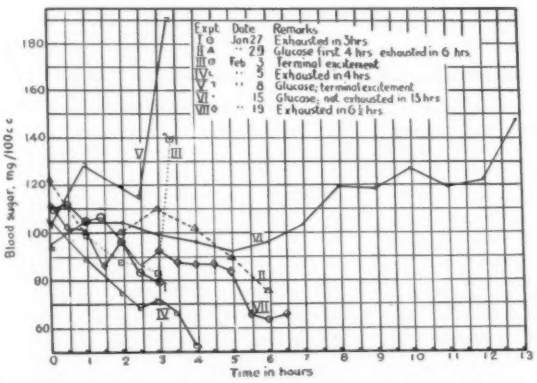
Record of a 17-Hour Run. Energy output, 176 kg.-m. per minute per kg. of body weight; a 5-minute Rest Period Each Half-hour Was Used for Making Observations and Supplying Water and Fuel.

TABLE III

ponents. For dogs weighing 12 to 14 kg. the horizontal component for each kg of body weight is 0.64 kg-m. per linear meter, and the vertical component, 2.92 kg-m. per linear meter through which his body is raised.

Under these conditions the best performance recorded in Fig. 3 when working without fuel was a run of 6½ hours to complete exhaustion. Four days before this when fuel was supplied, the same dog ran for 13 hours and was not exhausted at the end. The room temperature was 15°C. In each case, the rectal temperature remained between 39° and 40°C and blood lactic acid concentration remained near the resting level. Exhaustion came from depleted fuel in the 6½ hour run. The administration of easily available fuel in the 13 hour run resulted in twice the output of energy without exhaustion at the end and with the blood sugar level maintained at or above the resting level. The total energy outputs in these two cases were 46,150 kg-m. and 92,300 kg-m. per kg of body weight, respectively.

Two other experiments, not illustrated in Fig. 3, may be referred to briefly. With the treadmill running at the same rate, our second dog, with fuel supplied, ran for 9 hours. By that time, she was becoming tired and her temperature had risen to 41.3°C. The rate was decreased to 92 meters per minute, with the result that rectal temperature soon returned to normal, and she was able to run easily for 15 more hours. At the end of 24 hours, she was not exhausted despite an energy output per kg of body weight of 64,000 kg-m. during the first 9 hours and 79,000 kg-m. during the succeeding 15 hours, a total of 143,000 kg-m. In the other experiment, detailed in Table 3, Joe was used as a subject with the rate of work output one-fourth greater than in the experiments of Fig. 3. This higher rate of work output, 176 kg-m. per minute, is approximately the same as that which Rice and Steinhaus used. Under their experimental conditions, their dogs rarely ran continuously for 30 minutes. Joe, in this case, ran for 17



Performance of a trained dog in relation to blood sugar. The work rate was 142 kg.-m. per minute per kg. of body weight. The dog ran on a treadmill for 25 minutes at a time and then rested 5 minutes while blood was drawn for blood sugar determination. Starting in a fasting state and without food the dog showed a drop in blood sugar and was exhausted after 3 to 6.5 hours. When the dog was fed glucose candy each half-hour he ran 13 hours without exhaustion and with high blood sugar. This proves that in this grade of work the dog can become exhausted through depletion of readily available carbohydrate.

FIG. 3

hours with fuel supplied and was not exhausted at the end. The total work output was 150,000 kg-m. The distance covered was 132 km and the height of the climb was 23 km, about 2½ times the height of Mount Everest.

Temperature Regulation

We are not concerned with temperature regulation in this paper, but the limitation placed on performance by inability to keep body temperature within comfortable limits must be kept in mind. This is particularly true of exercise experiments on dogs. They have such a high capacity for transforming fuels that even at ordinary room temperature their exhaustion may come about directly as a result of high body temperature. At very high external temperatures Dill, Bock and Edwards (9) found that they may be unable to keep pace with man.

Moderate and Light Work

Books have been written about fatigue associated with the ordinary day's work. In industry, this may involve a rate of caloric expenditure of three to five times the resting level. In sedentary work, it may average no more than twice the resting value. So long as health is good, meals adequate, sleep sufficient, and the emotional state in balance, the fatigue experienced is taken in stride. When the day's work is done, paradoxically, the expenditure of energy at a fast rate is apt to begin. The day in the factory frequently is followed by work in the garden, by strenuous games or by dancing. The policy in many industries of encouraging sports among their workmen would receive little support if the day's work produced physical exhaustion. Classical methods for studying physical exercise have not been particularly fruitful in this field. The fatigue of the factory worker cannot be defined in terms of lactic acid, alkaline reserve, hydrogen ion concentration, hemoglobin or "toxin." The problem is too subtle to yield to the physiologist's measurements of pulse rate, blood pressure, respiration and circulation nor do the sensory tests used by psychologists give complete satisfaction. The degree to which the social environment affects performance in light industrial work has been studied by Mayo (21).

Summary: Aerobic Work

The fuels used in muscular activity are carbohydrate and fat. In moderate work, both are used; at the highest levels of aerobic work, the fuel is predominantly carbohydrate. Fatigue may be caused by exhaustion of carbohydrate reserves accompanied by depletion of blood sugar. Failure of temperature regulation may cause a breakdown when external temperatures are high, especially if the rate of energy exchange is high. Lactic acid does not increase in the blood in light or moderate work.

PHYSICAL FITNESS

Interdependence of Fatigue and Fitness

In strenuous physical exercise, the degree of fatigue experienced depends on the state of fitness. If a group of men, for example, climb a hill or run on a treadmill at the same pace, they can be differentiated by observations on heart rate, respiratory rate and blood lactate. Such a quantitative study of performance was made by Dill, Talbott, and Edwards (14). In a 20-minute run on the treadmill, heart rate varied from 132 to 180, respiratory minute volume from 50 to 80 liters per minute and increases in blood lactate from 0.8 to 5.9 milliequivalents per liter.

Fitness Tests

This topic is dear to the heart of physical educators. The number of fitness tests is legion. Rather than entering this controversial field, reference will be made to a number of valuable war-time studies, many of which remain unpublished. A graduate student interested in this field might well analyze these reports, most of which can be obtained from the specified military sources given in the bibliography.
fitness during the training stages; comparable studies of fitness in relation to combat performance were recommended. Erickson and associates (16) demonstrated the usefulness of the treadmill as a controlled work-output device in many situations, especially in precise evaluation of physical fitness. C. Taylor and Franzen(27) described the "Taylor" treadmill test of work capacity. It consists of an initial run of 1 minute on a 5% grade at 162 meters per minute. Each minute the grade is raised 1% until the subject stops from exhaustion. The score is the total work output. This test is only practiced in the laboratory; the same re-

Phillips (23) has reported a low but significant positive correlation between the three elements of the JCR test (jump, chin, run) and success in primary and advanced training. There was no correlation between the Schneider test score and success in primary and advanced training.

Graybiel and West (17) have measured physical fitness by "composite," "step," and "pack" tests. With few exceptions, the physical fitness of entering students was high. All had passed a screening examination designed to exclude those not meeting prescribed physiological and psychological standards. Among those who were approved for flight training, no relation was found between physical fitness and flight performance. It was concluded that it is apparently unnecessary to maintain superior levels of physical

port includes exploratory studies of submaximal tests but no definitive recommendation was made. This report contains an extensive bibliography. H. L. Taylor and associates (28, 29) found that subjects kept in bed for three weeks lost 15.5% in plasma volume while red cell volume remained unchanged. Blood volume decreased 9.3% the first week of reconditioning resulting in an increase in plasma volume but a decrease in red cell volume. During the subsequent 5 weeks' reconditioning, the blood volume and the red cell volume were restored. There were major evidences of deterioration in fitness during three weeks' bed rest. Pulse rates in moderate work ranged from 121 to 134 before bed rest and from 162 to 181 at the end of three weeks in bed, the mean increase being 45 beats per minute. This corresponds to a drop from a good to a poor fitness score. The report includes a valuable bibliography of 22 references.

Kark and associates (19) used the Harvard step test and pack test in tropical and temperate field studies to evaluate fitness among troops in U. S., Canada, the Pacific, and India. Analysis of the relations between individual clinical stigmata and biochemical measurements and between individual clinical stigmata and physical fitness scores revealed few significantly positive correlations. Such correlations as existed had no apparent physiological explanation. No support is given to the proponents of a large intake of vitamin or a low intake of animal protein.

Eichna, Bean, and Ashe (15) evaluated the fitness of a group of 125 enlisted volunteers by the AGF and AAF test, the Navy step test, and the Harvard step test. None of these tests is ideal; motivation — the "will-to-do" — may be an exclusive determinant of fitness as scored by any one of these tests. The authors consider than an officer who has worked with and knows his men is better able to evaluate their fitness than any fitness test yet devised. Men strive to attain better scores on repeated testing; the competition thus aroused is an incentive to improve fitness.

W. B. Bean and 11 associates (5) employed five methods for measuring the acceptability and adequacy of rations: Questionnaires; Caloric intake and consumption of individual items; Food wastage; Physical fitness by: AGF battery of tests; AAF battery of tests; Harvard step test; Appraisal by platoon and company commanders; Evaluation of nutritional state by: Clinical examination; Biochemical measurements.

The following essential conditions were met:

- Enough subjects for valid results — a battalion of 827 men plus officers.
- Enough time for valid results—9 weeks' isolation.
- Experienced and competent testing personnel.
- Military training resembling combat.

Significant conclusions were:

- *Medical status*: No vitamin deficiency disease appeared. General health was excellent. No ration imposed any physiological handicap.
- *Biochemical status*: Within the limits of time of this test, variations observed in vitamin levels were of no significance.
- *Military efficiency and morale*: Improved substantially on all rations.
- *Physical fitness*: Scores improved in all tests throughout the nine weeks regardless of ration. The only possible conclusion is that all of the rations *when eaten under the circumstances of this test* were adequate for maintenance of physical fitness and activity for troops in arduous training.

This report contains the greatest body of reliable diversified data on physical fitness of troops during training. Incidentally, the study is a significant contribution to high altitude physiology. The troops had been previously conditioned at Camp Carson, 6100 feet. The study itself was conducted at altitudes ranging from 8700 to 9000 feet.

In a later report, Bean and associates (6) critically reviewed the AGF and AAF batteries of tests, the Harvard step test, and the Navy step test, all of which were employed in numerous investigations in their laboratory, now called the U. S. Army Medical Research Laboratory. They reached the following conclusions:

None of the tests is satisfactory for discriminating among degrees of individual fitness. This fault arises from:

- Failure to test chief components of fitness.
- Inadequate scoring system.
- Abnormal distribution of performance achievement and/or score.
- Lack of reproducibility.
- Inability to control or measure motivation.
- Inequality of stress on all subjects.
- Failure to consider physiologic cost or post-exercise conditions.
- Presence of test components where readily acquired skills permit subjects to "beat the test."
- Failure to consider environment or physique in scoring systems.

On the other hand, it was concluded that:

- Several of the tests are satisfactory as gross measures of fitness and permit satisfactory comparison of groups.
- A battery of fitness tests gives a better measure than a single test.
- Performance tests, when competition is aroused, serve as incentives to improve fitness.

The authors further concluded that experienced line and non-commissioned officers, familiar with their men, can appraise fitness as well or better than is done by existing fitness tests. They recommended that a far-reaching program of basic investigation in physical fitness and reliable methods for testing be included in the plan for post-war medical research for the Army.

Fitness of American Youth

If one judges by health and life expectancy, the American youth is more fit physically than ever before. If one judges by certain physical fitness tests, our boys and girls are woefully unfit. The pros and cons were weighed in the *U. S. News and World Report* for 2 August 1957(2). It does appear that many of our youth are softer than ever before and that this reflects over-attention to highly organized sports for the few and failure to provide physical training and sports for the many who are not of first-team caliber.

This last topic was given forceful attention recently by Morris (22). The President's Council on Youth Fitness has held two conferences on the fitness of American Youth, the first at Annapolis in June 1956 and the second at West Point in September 1957 (1). Among the recommendations of the second conference were several dealing with research. In particular, it was recommended that immediate concentrated research be directed towards:

- Scientific testing and evaluating of human fitness, with a view to developing simple but effective methods and standards for general use in measuring fitness.
- Measuring on a scientific basis the contribution of various sports, exercises, and activities to the development and maintenance of fitness of the whole individual as well as in particular elements for both sexes at different age levels.
- Discovering the reasons for lack of participation in effective youth fitness programs, and the factors which motivate children as well as parents to participate.
- Inventorying facilities and appraising their use for youth fitness programs.
- Assessing of trained personnel and development of methods for enlisting and training necessary additional leadership.

SUMMARY

No attempt is made in this paper to define fatigue, but some of its manifestations are described. There is at least one common feature among these manifestations whatever the type of fatigue — a disturbed balance between wear and repair. Attention is directed to the factors which affect the capacity of man and dog for work and the fatigue associated with exhausting work of short or long duration.

In races of short duration, peak speeds are reached at about 100 meters but fatigue associated with high lactic acid concentration in the blood prevents this rate from being maintained for more than a few seconds. In this sort of activity, energy reserves are used that do not require oxygen. An oxygen debt is contracted which is paid off by oxidative reactions in recovery.

As the duration of work increases, the rate falls off and a larger and larger portion of the energy is supplied directly by oxidative reactions. Fatigue involves depletion of the most efficient fuel, carbohydrate, and may also involve breakdown because of high body temperature. Fitness depends on efficiency, *i.e.*, a minimum of wasted effort, and also on a high capacity of the respiratory-circulatory systems for supplying oxygen to tissues.

It is significant that the President's Council on Youth Fitness recommends more research designed to assess the need for youth fitness and to provide a yardstick for fitness progress.

REFERENCES

1. Fitness of American Youth. Conference conducted at the U.S. Military Academy, West Point, New York, September 9-10, 1957. Washington: U. S. Government Printing Office, 1957.
2. Is American Youth Physically Fit? *U. S. News and World Report*, 43 (5): 66-77, August 2, 1957.
3. *The World Almanac and Book of Facts for* 1956. New York: *World Telegram and Sun*, 1956.
4. Balke, B., Personal communication. 1957.
5. Bean, W. B., and eleven associates, Field Test of Acceptability and Adequacy of United States C, K, 10-in-1 and Canadian Army Mess Tin Rations. Project No. 30, Armored Medical Research Laboratory (Army Medical Service Field Research Laboratory), Fort Knox, Kentucky, Nov. 22, 1944.
6. Bean, W. B., C. R. Park, D. M. Bell, and C. R. Henderson, Critique of Physical Fitness Tests, Sub-project AMRL 56, AMRL Report No. 3, Armored Medical Research Laboratory, Fort Knox, Kentucky, Feb. 19, 1947.
7. Black, E. C., Blood Levels of Hemoglobin and Lactic Acid in Some Freshwater Fishes Following Exercise. *Fisheries Research Board, Canada*, 12: 917-929, Nov., 1955.
8. Christensen, E. H., Beitrage zur Physiologie schwerer korperlicher Arbeit. I-IX. Mitteilung. *Arbeitsphysiol.*, 4: 128-203, 453-503, 1931; 5: 463-489, 1931-32; 7: 108-128, 1933-34.
9. Dill, D. B., A. V. Bock, and H. T. Edwards, Mechanisms for Dissipating Heat in Man and Dog. *American J. Physiol.*, 104: 36-43, April, 1933.
10. Dill, D. B., and H. T. Edwards, Physiochemical Properties of Crocodile Blood (Crocodilus acutus, Cuvier). *J. Biol. Chem.*, 90: 515-530, February 1931.
11. Dill, D. B., H. T. Edwards, and R. H. DeMeio, Blood Sugar Regulation in Exercise. *Am. J. Physiol.*, 111:9-20, February 1935.
12. Dill, D. B., H. T. Edwards, and J. H. Talbott, Studies in Muscular Activity—VII: Factors Limiting the Capacity for Work. *J. Physiol.*, 77:49-62, December 1932.
13. Dill, D. B., H. T. Edwards, J. H. Talbott, A. V. Bock, and C. Daly, Unpublished, 1929.

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PROGRESSIVE RESISTANCE EXERCISE IN CORRECTIVE THERAPY*

DAVID H. CLARKE, PH.D.**

There can be no doubt that an effective way to increase muscular strength is to exercise the muscles directly by means of some system of weight training. Corrective therapists and of course others in the field of rehabilitation have long been interested in this phenomenon, especially as it applies to the hastening of recovery or the attainment of specific functional skills in hospitalized patients.

Although the use of resistive exercises for therapeutic benefits extends in history from earliest man, the application of exercise to develop the body and to correct physical defects actually originated long before formal rehabilitation was recognized and prior to the formal beginnings of physical education. As Clarke (7) has pointed out, "records and drawings have been found showing the use of crude corrective gymnastics by the Chinese about 3000 B.C. There is evidence of the use of exercise, massage, and baths by the early Egyptians, Hindus, Greeks, and Romans." Study of the historical evolution of formal exercise is both fascinating and enlightening, and of importance to therapists and research workers interested in particular aspects of this special field.

Physiological Considerations

Equally interesting is the study of early concepts regarding the manner in which fuel and oxygen taken in by the body are converted into the energy of muscle shortening. These physiological considerations give us an understanding of the actual mechanism involved when weight X is lifted distance Y. Undoubtedly, a certain aura of mysticism has been associated with bodily functions, the mechanisms of which cannot be directly observed. As far back as the Second Century, A.D., Galen felt that some manner of "animal spirits" passed from the brain via the nerves into the muscles and caused transverse swelling and longitudinal shortening, a concept that persisted for some 1400 years (10). Since that time, scientists from many countries have contributed information leading to our present theories of energy transformation in muscle. For a more complete review of the literature of the physiology of progressive resistance exercise, two articles in this *Journal* by Rasch (16,17) are suggested as excellent references.

Static Exercise

Perhaps some of the most stimulating research to come to our attention in recent years is that of Dr. Erich A. Muller of the Max Plank Institut fur Arbeitsphysiologie in Dortmund, Germany. His experiments into methods of increasing muscular strength have led some newspapers in this country to suggest, at least in so many words, that at last we had found "the goose that laid the golden egg." However, there is some skepticism that all is not as simple as at first was hopefully thought to be true.

In one study, Muller, in collaboration with his student Hettinger (12), investigated the effect of static (or isometric) muscular contractions as a training method for increasing strength. They conducted 71 separate experiments on nine subjects over a period of 18 months. The exercise consisted of holding a predetermined tension against a spring scale, utilizing primarily the elbow flexor and extensor muscles. Their training sessions were conducted five days a week with Saturday an occasion for measuring maximum strength. Some of the conditions that varied were: intensity of contractions, length of time they were held, and the number of practice sessions per day.

These investigators found that apparently muscular strength increased more rapidly when the intensity of training reached about two-thirds of maximal strength: additional load seemed to have no further strength-increase effect. Also, their results indicated that one practice period per day during which the tension was held for six seconds resulted in as much increase in strength as did longer periods and more frequent practices. One of the significant points made in the discussion of these results was that the cause of the increase in strength was believed to be dependent upon the amount of oxygen deficit rather than the intensity of contraction or the degree of exhaustion of the fibers. They further reported that a training load of less than one-third maximal strength produced no hypertrophy, perhaps because this produced an insufficient oxygen deficit. In fact, subsequent work by Hettinger (11), employing a work load of one-fifth of the maximal strength, supported these findings by producing no strength increases.

In order to investigate the extent that muscular contraction is effective in occluding circulation of the muscles involved in static exercise, and thereby

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bringing about an oxygen deficit, Royce (18) studied these factors under conditions of both normal and occluded circulation. He tested a group of subjects on a spring-loaded Smedley hand dynamometer under two sets of conditions, as follows: the first condition consisted of a static contraction of the gripping muscles which was kept at maximum effort for a period of 90 seconds; the second condition was given in the same manner, but the circulation was cut off by a pressure cuff around the upper arm inflated to 220 mm. Hg. Analysis of the resultant fatigue curves showed no difference for the two conditions until 50 seconds had elapsed, at which time the occluded curve continued its downward trend, while the non-occluded curve also did so, but to a significantly lesser extent. The point at which the two curves separated was approximately at 60 per cent of the initial strength. This gives us indirect evidence that the circulation was effectively occluded by internal muscle pressure and also gives more exact data than was available for the Hettinger-Muller interpretation of the amount of tension in which the muscle pressure caused by isometric contraction and the blood pressure balance each other.

Carrying these concepts one step further, this writer felt that if the blood flow through the muscles is impaired during the maintenance of tension, then much of the energy cost of a contraction, if it is held for very long, would have to be paid off in the form of oxygen debt after the muscle has relaxed. In contrast, the periodic compression and relaxation of the muscle pressure against the veins during dynamic work would tend to promote local blood flow and thereby increase the oxygen transport during exercise, thus resulting in a comparatively small oxygen debt. Recent experimentation bears this out (3). The oxygen consumption of 24 subjects was measured with a closed-circuit metabolism apparatus during rest, five minutes of isometric exercise, and recovery (all in the standing position). The first exercise period consisted of the subjects holding a 50-pound weight by the hands with knees partially flexed. Second and third tests were given in the same manner using 35-pound and 20-pound weights. When compared with a dynamic exercise at comparable metabolic work loads, there was a significantly smaller oxygen income during work and a larger oxygen debt, thus supporting the theory that the circulation was being occluded by the muscle tension.

It is interesting to note the development of knowledge pertaining to the effects of isometric resistance exercise. However, the results of recent experimentation should come as no surprise, for static exercise is not new, and especially is it not unknown to therapists and rehabilitation workers who have for years understood, at least from a practical standpoint, many of these concepts. This is best illustrated by the use of muscle "setting" exercises which have been employed by therapists, especially when joints are immobilized or pain limits range of motion. If performed vigorously and sustained for a sufficient length of time, there can be no doubt of the efficacy of this procedure as a technique for increasing muscular strength.

Dynamic Exercise

From time to time another question has arisen when discussing the best way in which to administer progressive resistance exercises, which is essentially this: is it best to lift the weight slowly or perform the repetitions rapidly? This is not merely a question of static exercise on the one hand versus dynamic (or isotonic) exercise on the other; rather, it concerns more exactly the methodology in dynamic exercise. Certainly, there is a place for PRE as we know it in the treatment of muscular weakness, especially when it is important to exercise a group of muscles through a wide range of motion. Inasmuch as different motor units become activated in different anatomical positions, it is readily apparent that more muscle fibers will contract if the excursion is larger. What, then, is the answer — shall we make the movements fast or slow?

Apparently, there is a paucity of information that directly bears on this problem. It sometimes appears as if we assume that the heavier the weight lifted the better is our exercise technique. However, this may not necessarily be the case at all. It may very well be that the *manner* in which the load is lifted is far more important than how much it actually weighs.

Fortunately, there is some indirect evidence that may provide a better understanding of the process involved in progressive resistance exercise. As has been pointed out, static exercise causes an occlusion of the circulation with the resultant lack of oxygen to the tissues, a situation that leads to an imbalance of the depletion-replenishment mechanism, and brings about muscular fatigue. When fatigue curves for given amounts and durations of exercise are analyzed, rather interesting comparisons can be made. Several experiments into this phenomenon have been undertaken at the University of California. In all cases the spring-loaded Smedley hand dynamometer was used, the subjects squeezing maximally at all times. Fatigue curves were obtained for exercise performed under the following experimental conditions:

1. An isometric (i.e., static) contraction maintained for a period of 90 seconds (18).

2. An isotonic (i.e., dynamic) exercise consisting of the subjects contracting the forearm muscles

once every four seconds for twelve minutes, and, again, once every second for six minutes (15).

3. Finally, an isometric contraction that is sustained for four seconds, released for one second, and repeated for a total of six minutes (1).

When each of these four fatigue curves are smoothed and plotted as a function of force on the one hand and time on the other, very pronounced differences can be seen. Performing muscular contractions once every four seconds shows very little fatigue, although, quite probably, some is present; the difference between initial and final strength is less in this situation than in the others. Exercising once every second, on the other hand, shows a very pronounced drop in strength to the steady-state level, which, although much lower than in the previous condition, is still slightly higher than the next, or third, series of holding the contraction for four seconds and releasing it for one. Not only the fatigue level, but the over-all shape of this latter curve more closely approximates the curve for true isometric contractions, which describes a rapid fatigue, and reaches its asymptote (or plateau) at the lowest degree of strength.

The question of interpretation of these findings becomes a little philosophical, because at best it only indirectly applies to our initial problem of methodology of exercise administration. Also, many factors are involved that cannot be resolved here. However, other things being equal, and accepting the original hypothesis that increasing muscular strength is dependent to some extent at least upon an oxygen deficit in the tissues being exercised, then it would seem from analysis of these fatigue curves that performing repetitions slowly, and even sustaining the contraction for some seconds would be highly advantageous. The alternative apparently is to go to the other extreme and perform the exercises very rapidly, as the fatigue curves in both instances approach that of the isometric contraction. The common denominator is probably the rest interval allowed between successive efforts, for the purpose of the exercise would undoubtedly be lost if recovery took place between repetitions.

It would seem of importance to further investigate various of these factors, especially from a practical standpoint, so that more direct evidence can be brought to bear on a number of problems. We do know from the physiology of muscular activity that the contraction process is complex, and we cannot safely label any one factor as more important than another. However, it is necessary to investigate many facets of exercise in an effort to determine some of the cause and effect relationships.

Objective Determination of Resistance Load

The final phase of progressive resistance exercise that will be dealt with is that of the determination of the maximum capacity of any muscle group, and, in particular, to determine the resistance load for the final ten repetitions. Especially applicable to DeLorme's procedures(8), it has been a constant problem of therapists and technicians to determine with as little delay as possible, the amount of weight that can be lifted ten times, inasmuch as this is probably the most widely used method of exercise administration.

In 1953, Klein and Johnson (14) published a paper in which they suggested a method of determining this maximum load for development of the quadriceps muscles. They stated that their subjects could usually produce a knee-extension bout of ten repetitions maximum when the resistance load was five pounds less than the amount of weight they could lift on a single effort.

However, two years later, the writer, together with E. L. Herman (4) proposed a method quite dissimilar from that of Klein. Utilizing a cable-tensiometer to measure the maximum static strength of the quadriceps muscles, a group of subjects were given five knee extension exercise bouts based upon 30, 35, 40, 45 and 50 per cent of this amount. In each instance, the subjects were instructed to perform as many complete repetitions as possible. The results showed that a very linear pattern of repetition decrement from the light to the heavy resistance loads was present for both right and left legs, and that a value of 50 per cent of the strength of the muscles tested was found to be reasonably satisfactory for determining the ten repetitions maximum.

It should be pointed out that although a cable-tensiometer was employed, it is possible to use some other measuring device such as a strain gauge, a dynamometer, or a heavy spring scale, although objections have been raised concerning this latter instrument (6). As a matter of fact, with this linear arrangement of repetition decrement, it is quite possible to calculate the weight necessary for ten repetitions maximum merely by performing an initial bout utilizing any random weight (2).

In exercising the muscles around the knee joint, the quadriceps group probably receives most consistant emphasis, even though it has been demonstrated that hamstring weakness accompanies quadriceps deterioration following injury (13). No doubt the hamstring muscles and other knee flexors should be given equal consideration in many of our treatment procedures for knee disabilities. In an effort to expand the concept of objectively determining resistance loads for ten repetitions maximum, the author, together

with R. N. Irving (5) applied a similar research design to the flexor muscles of the knee. Utilizing again a cable-tensiometer for measuring the maximum static strength of these muscles, the subjects performed as many repetitions as possible utilizing weights that were 40, 45, 50, and 55 per cent of this strength. Results indicated that employing 55 per cent of strength was quite satisfactory for obtaining the desired ten repetitions maximum. Again, there appeared to be a linear decrement of repetitions from light to heavy work loads, although the curve was much more steep than was true for the quadriceps exercise. In addition, there were more individual differences apparent at the lighter loads for knee flexion exercise. Undoubtedly, this reflects the basic differences that exist in the type of joint utilized, the muscular attachments, and the exercise procedures employed. While a given weight is appropriate for one exercise, it may be entirely unsatisfactory for use in another. It seems that there is some specificity of strength among the various joints of the body, a situation that may be accentuated when exercise is performed.

Conclusion

It has been suggested that "the advancement of any new field of medicine depends upon a parallel development of treatment, teaching and research, and that, in importance, research is by far the greatest"(9). The emphasis upon scientific investigation in adapted and corrective therapy as well as in physical education is greater today than it ever has been. We share a special interest in the field of progressive resistance exercise, and indeed there are many things yet that we do not know. It has been the purpose of this paper to bring together some of the information available in certain limited areas of exercise and exercise physiology in an effort to examine some of the concepts that direct our approach to the treatment of hospitalized patients.

REFERENCES

1. Carston, Dolly, "The Influence of the Contraction Duration on Fatigue Curve Parameters in Dynamic Muscular Work," Unpublished Masters Thesis, University of California, Berkeley, California, 1959.
2. Clarke, David H., "The Application of Measurement to Quadriceps Exercise Prescriptions," *Journal of the Association for Physical and Mental Rehabilitation*, 11: 48, 1957.
3. Clarke, David H., "Energy Cost of Isometric Exercise," Unpublished Paper, University of California, Berkeley, California, 1959.
4. Clarke, David H., and E. L. Herman, "Objective Determination of Resistance Load for Ten Repetitions Maximum for Quadriceps Development," *Research Quarterly*, 26:385, 1955.
5. Clarke, David H., and R. N. Irving, "Objective Determination of Resistance Load for Ten Repetitions Maximum for Knee Flexion Exercise," Unpublished Paper, University of Oregon, Eugene, Oregon, 1958.
6. Clarke, H. Harrison, "Comparison of Instruments for Recording Muscle Strength," *Research Quarterly*, 25: 398, 1954.
7. Clarke, H. Harrison, "Relationships in Developmental and Remedial Physical Education and Corrective Therapy," Unpublished Paper, presented at the Meeting of the AAHPER, Portland, Oregon, April 1, 1959.
8. DeLorme, Thomas L., *Progressive Resistance Exercise*. New York: Appleton Century Crofts, Inc., 1950.
9. Fleer, Paul F., "Research: A Distinct Responsibility of the Corrective Therapist," *Journal of the Association for Physical and Mental Rehabilitation*, 7:184, 1953.
10. Fulton, J. F., "Muscular Contraction and Reflex Control." Baltimore: Williams and Wilkins, 1926, from Henry, F.M., *Physiology of Work*. Berkeley: University of California Press, 1950.
11. Hettinger, T., "Der Einfluss der Muskeldurchblutung beim Muskeltraining auf den Trainingserfolg," *Arbeitsphysiologie*, 16:95, 1955.
12. Hettinger, T., and E. A. Muller, "Muskelleistung and Muskeltraining," *Arbeitsphysiologie*, 15:111, 1953.
13. Klein, Karl K., "Progressive Resistive Exercise and its Utilization in the Recovery Period Following Knee Injury," *Journal of the Association for Physical and Mental Rehabilitation*, 10:94, 1956.
14. Klein, Karl K. and E. Johnson, "Research: A Method of Determining the Maximum Load, for Ten Repetitions, in Progressive Resistance Exercise for Quadriceps Development," *Journal of the Association for Physical and Mental Rehabilitation*, 7:4, 1953.
15. Kurimoto, Etsuo, "Effect of Inter-Contraction Rest Interval on Muscle Fatigue Curve Parameters," Unpublished Masters Thesis, University of California, Berkeley, California, 1959.
16. Rasch, Philip J., "Studies of Progressive Resistance Exercise: A Review," *Journal of the Association for Physical and Mental Rehabilitation*, 12:125, 1958.
17. Rasch, Philip J. and R. V. Freeman, "The Physiology of Progressive Resistance Exercise: A Review," *Journal of the Association for Physical and Mental Rehabilitation*, 8:35, 1954.
18. Royce, Joseph, "Isometric Fatigue Curves in Human Muscle with Normal and Occluded Circulation," *Research Quarterly*, 29:204, 1958.

VA CITES TRANQUILIZERS

Five widely used tranquilizing drugs tested simultaneously in 34 Veterans Administration hospitals have been found effective in treating schizophrenia, a major mental illness which fills more than half of the hospital beds in the United States, the VA has announced.

One tranquilizer (mepazine) was relatively weaker than the others, but the remaining four (chlorpromazine, proclorperazine, trifluprornazine, and perphenazine) were not different from each other in therapeutic effectiveness. All five drugs were superior to a control substance (phenobarbital) against which they were tested.

Improvement of severely ill mental patients in the 34-hospital study included alleviation of emotional and thinking disturbances as well as generally improved behavior. Specifically, patients became less resistive and belligerent and their thinking became less disorganized. These changes were reflected in discharges from the hospitals and in a decrease in the amount of nursing care required.

The safety of the drugs was demonstrated by the fact that although more than 600 patients were included in the study, the occurrence of allergic reactions, drowsiness, and other such complications was neither frequent nor troublesome.

The five different tranquilizers and phenobarbital were administered during the latter part of 1958 to a total of 640 schizophrenic patients in the 34 cooperating hospitals over a period of 12 weeks. Clinical teams made three separate evaluations, one at the beginning, another after one month, and a third at the end of the treatment period.

Findings of the study were reported recently at the VA's Fourth Annual Research Conference on Cooperative Studies of Chemotherapy in Psychiatry, held at the VA hospital in Memphis, Tenn. The study was directed by the VA central neuropsychiatric research laboratory at the Perry Point, Md., VA hospital. The computations were carried out through the facilities of the National Bureau of Standards.

EMOTIONAL FACTORS IN LEARNING TO SWIM

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Much has been written on the qualities essential to a good swimming teacher. Characteristics such as patience, humor, ability to give simple, well paced directives in instruction are necessary for good teaching. It is apparent that people both young and old, who come to learn to swim, bring with them their conflicts, guilts, anxieties and their ambivalances. In other words, everything they are and how they function in the outside world are to be considered in their relationship with the swimming instructor. Therefore, another qualification for a swimming instructor is indicated — an understanding of human reactions.

This paper deals with the personality structure of the subject who comes for swimming instruction, and how the instructor utilizes understanding of the student personality during the swimming lesson. A sensitively disposed swimming instructor, who is able to capture the revealing personality patterns and the body langauge of each individual, can incorporate in the criteria for teaching the significance of such patterns of behavior. With this goal as a basis, an intuitive teacher can then tap the natural resources and attain success with rigid, fearful pupils of all ages.

The dependency of the pupil as seen by the instructor can date back to his earlier childhood fears, *i.e.,* of death. These fears are reactivated in relation to the water environment which the pupil feels can so completely and fatally envelop him. Therefore, the instructor must first obtain the pupil's absolute trust in him, as the one who can assure his physical safety, thus creating a unique relationship. Observation of the pupil's behavior and timely, well considered interpretation to him, are basic to his progress.

In teaching swimming, if the instructor has an understanding of some determinate psychological patterns, such as the common causes of the fear of water, he can use this knowledge advantageously in his instruction. Therefore, psychological understanding can be utilized in the teaching of swimming and often produces some therapeutic effects which may be observed while the pupil is learning to swim. This statement in no way implies that swimming instruction can be used as a substitute for psychotherapy. However, through proper swimming instruction, unconscious fears may be reached.

The uniqueness of the teacher-pupil relationship lies in the unusually close physical contact, the limited time, the verbal communication and the fact that the teacher represents a security or authority figure; all these combine to return the pupil to his infant feeling of either helplessness or trust. The pupil learns that he takes no step which will bring his fears again into focus as he safely proves his ability to himself each step of the way. He also finds that he has gained distance from his inner problems (fears). Through instruction, observation and interpretation, the pupil gains insight which helps him to lessen his fears as he learns each successful step towards swimming with freedom. Some deep areas of conflict seem to become accessible to resolution during the period that a person is taking swimming lessons. This observation has led to the conjecture that a research project might prove valuable if the subjects for the study were simultaneously being psychoanalyzed and availing themselves of this type of swimming instruction. The conjecture is then stated, would the swimming pupils during their psychoanalytic hours have more direct access to the origin of their neurotic patterns in general? As will be shown by later example, it is this author's considered opinion that deeply set personality patterns are shaken loose and could be rendered more accessible for the psychiatrist to reach and ameliorate.

The pupil recaptures those sensuous feelings experienced by the infant while he is in the bath and in the warm, accepting and tender ministrations of a good mother. Once this is consciously accepted by the pupil, then the unspoken nod, the verbal persuasion, and an inferred permission to accept and indulge becomes the vehicle. Praise for accomplishment and simple, direct instruction in the mechanics, help in the letting-go of the dreaded fear of water. Suffocation and death as conscious or unconscious ever-present dangers slowly recede to the background as the pupil gains ego strength through support and small successes in mechanical achievement in learning to swim. In the development of this highly differentiated, individualized approach to the teaching of swimming based on how the pupil reveals himself in the teaching situation lies a pattern of creative and dynamic swim-teaching. This new method apparently results in an inner freedom in water and the final satisfying ability to swim comfortably.

Water becomes a great and natural leveler. While water often activates primitive fears, it also seems to be a locale to be more thoroughly investigated for its inherent therapeutic effects. Its potentials are believed to be unlimited as an adjunct to psychotherapy.

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The methodology used in this teaching situation seems closely to symbolize the mother-child dependency relationship, and the infant's need for survival. Add the primitive environment of water and an inherently dynamic stage is set for learning. The body, shorn of pretense, is denuded of its sophistication, the defenses are off guard and the relationship of swimming teacher and pupil is entered into literally stripped for action. The drama then unfolds with each succeeding lesson.

In presenting to the pupils some of their own defenses that prevent learning in the water, they are shown why they are so bodily and emotionally immobilized.

For example, a woman pupil (mother of two teen-age boys) whose eyes drifted nervously towards the clock on the wall needed to make certain she was using up all of her allotted time. She was also determined to "get" as much from the instructor in her half hour, as time and knowledge would allow. The need to get her "money's worth" and to berate herself for not successfully utilizing instruction inhibited her muscles to the point that, anxiety-laden, her body floated heavily and uneasily in the water. She could not maintain buoyancy and glided toward the bottom of the pool. It may be pointed out that this tension-giving concern with time was mainly responsible for her inability to relax and learn as fast as she felt she would. She accepted this with light humor. However, when this pattern persisted, the instructor held her ground, and the pupil finally sobered and realized that this was actually true. It was pointed out and demonstrated that without tension producing attitudes, her buoyancy would increase and relaxed floating would follow. Effort was further sought to identify the few remaining tension filled muscles, by touching the tension spots lightly, utilizing the tactile sense and verbally exhorting the pupil to relax them as she lay stretched out on the water. The heightened buoyancy resulting was proof of her remark, "I feel the water rocking me; I feel like a leaf floating downstream," and further, "This feeling I'd want to keep forever. I never floated so high in the water." Unconscious tension is pointed out with "Be gentle, don't fight the water, let it work for you."

This particular pupil soon learned the mechanics in this newly acquired relaxation and quickly moved on to swimming freely. She used the word "joy" to describe her new found freedom in water. In a social situation one was impressed with her posture and aura of well being. This offered the opportunity to ask if she could tell what, if anything, she had experienced by my method of teaching. She smiled and replied directly that her feelings of inferiority are not as pronounced and she doesn't fear the water. She said, "I respect it, but feel safe in it."

That fear generates tension in the muscles, which impedes swimming progress, is well demonstrated in the case of George. His physical immobilization and blind unreasoning fear of water left no room for rational thinking. Rigid, utterly lacking in any knowledge of self-help in the water, and literally blindly groping, (with eyes closed in reality) he appeared as a frightened little boy. A father of two growing children, successful in business, and a trombone player, he was beset by his wife who threw him the gauntlet. She said his two children swam, she swam, and he simply had to learn. Added to this pressure was his apparent discomfort with a female instructor in such close proximity. He seemed a sorry picture, indeed, as he presented himself for his lesson. That it was difficult for him to accept physical support (he measured six feet one, and from one who was only five feet and a half inch), was apparent. When he finally accepted being held in a back float, he proved a dead, tight weight, and he desperately clutched the side of the pool, while tightly encircling the instructor's waist with his free arm. In deep water he was the material that rescuers would shy away from, since he could easily drag his rescuer or teacher down with him.

Progress was slow, but he did progress, and he was soon addressing me as "coach," despite the ample feminine lines. He evaded making appointments, and they were made from time to time by his wife. He would apologize and ask to be excused for his lack of "stick-to-itiveness." His spotty swimming appointments, however, brought him to the point where he could float quite easily, face downward and eyes open, a real feat for a fearful beginner. This represented to him the epitome of a successful endeavor. He pretended that he arrived at that point where just a few more lessons would round out his course, and he would be finished. His pitiful attempts at swimming, child-like and gasping, would be followed with "See, I'm swimming, coach." At one point, in taking up his inability to loosen up and his constant testing of the instructor, it was mentioned that he didn't trust his coach ("How can you say that, coach?") However, both knew this lack of trust in people generally, and in the water specifically, was basic to him.

At each point of awareness, when he grasped inferences relating to his defenses, he made this understanding work for him. He joshed good naturedly and he semed pleased. He accepted these inferences as though he were playing a game and laughed awkwardly as attempts were made to prove how he used

these defenses unconsciously to hinder him in the water. The pupil-instructor relationship ended at the point where he would continue "next summer." One could feel his grateful regard for the intervention of autumn and its cooler weather. It was a welcome escape for him. When countered with the statement that he could easily continue in an indoor pool for the winter months, he replied, "I'm only a summer bather, I hate cold weather," and "Don't forget, coach, I'm starting early next summer again."

George's progress up to this point was based on an intensive study of his personality patterns in his water environment. The results, though slow, were gratifying on both sides. He proudly demonstrated his skill to his wife. The next summer he reappeared for swimming instruction. Obviously, George would benefit if he were having psychotherapy. He is the kind of person who would easily fit into the aforementioned research project where swimming instruction and psychotherapy are simultaneously in progress.

The delicacy and variety of feelings experienced by frightened beginners presents each time a new format for the instructor to sketch in and build on. It is the feeling that more than half the battle for successful learning in water is won when unspoken fears are brought to consciouness and body language and defenses are understood in the light of their real meanings. Intutition, combined with insight, are blended to promote growth and movement in the best interests of the pupil. The following history of a learning situation with a seventeen year old girl emphasizes this point:

Terry, a highly over-protected teen-ager appeared slow in speech and movement. Her face was set in a benevolent smiling mask. She angered easily. Rigidly philosophical in her outlook, she aimed to please. Her entry into the pool each time, resembled the attempts of a three year old to navigate the steps into the pool. Clinging with both hands to the side, she would set one foot down on a step and bring the other foot to it. She would finally dip down into the pool up to her neck, with a straight, rigid back. There was literally no bend to Terry. A didactic compliance with teacher's simple instructions was characteristic. She expressed impatience and sometimes real disgust with herself at her inability to follow through. At about the third lesson, she clearly manifested discouragement with herself and was careful not to blame the teacher for her lack of progress. She was unhappy. She complained that her brother learned at a more rapid pace. The inner freedom to twist, bend, jump or turn was repressed and translated into worriment over movement in general. Each step was calculated as she appraised the risks involved. She reported her discouragement to her parents. The money spent for the lessons bothered her. With little buoyancy, her body lay as a stone in a face-down float, bent at the knees, and she would find herself half way down to the bottom of the pool. Her attempts to gain a standing-up position, showed little understanding of self-help. She readily evinced embarrassment for her clumsiness. However, she accepted suggestions and attempted earnestly to follow them.

In four lessons, Terry navigated the swim across the pool. She seemed victorious. She could not, however, integrate breathing properly into the process. Her mental and physical immobilization was stronger than her desire to order body change and movement. She was an automaton with a metronome guiding each stroke.

The instructor praised her efforts and experimented with an offer of two free lessons because of her cooperation in the past. The first of these lessons showed a radical step-up of buoyancy in the water. Her remark, "I got a lot out of this lesson, didn't I?" and "I'm much better," seemed reminiscent of the child who tries harder because "Mom loves me, so I will work for her."

Since organic and/or psychological disfunction was suspected, Terry was referred to a social agency for help. The parents agreed quite willingly. The last contact revealed that both Terry and her parents were being seen by a social agency once a week. A complete workup of neurological and other physical and mental tests were in progress. Under investigation as well was her ability to function socially at school, and in other areas of her life. The parents who heretofore had suspected "something was wrong" with Terry and had never acted on this, expressed appreciation for the change of goal with Terry. The swimming lessons were suspended pending results of the testing. She was finally referred by the social agency for psychiatric treatment.

In this case the swimming lessons led to the study of the personality structure. There is every reason to believe that at a later date, a healthy Terry will swim and live life more fully.

In the following case of Freddie, age 7, the instructor used only those surface defenses as disclosed by the pupil in relation to the swimming and teaching situation.

Quick, wiry, and over-active, Freddie seemed in perpetual motion and emotion. A show-off, exaggerated in his reactions, he was brought for swimming lessons by his annoyed and detached mother. She is a widow, pretty and indulgently distressed at this bundle of activity. She confided that Freddie was terrified of the water. Time was allowed for showing

off, humor and his incessant running out of the pool to dry off his face each time he dunked his head under water. He pretended to drown and yelled weakly for help. When it was mentioned that his over-activity in the previous lessons was preventing him from listening to instruction, he countered with, "I'll handle that part and I'll talk to myself and you handle the teaching." He added, "I'll talk to it and tell it to stop."

When he finally sobered down and tried to follow directions, he intermittently hit himself on both sides of the face, yelling, "I can't do it, I can't do it." Effort was made to enter into his struggle and laughingly, he was told his skin doesn't like to be hurt, to be gentle to it. He stopped hitting himself. He reverted, however, to this behavior after periods of trying to follow directives, not too successfully. With instructor's arms supporting his body firmly, he was floated on his back. Arms, as in the infant, remained close to his body, bent at the elbows with his fists clenched. Gently, each fist was unclenched and it was explained that if he relaxed the complete arm, it would float on top of the water, and it did. We talked about it. He was amused, still resisted, and made feeble struggles to get up and kept a stream of chatter going, "Don't let me go, hold me, I'll drown, remember you promised . . . "

The mother joyously reported weeks later that on a mountain trip, Freddie cavorted in a lake and dove underwater, with eyes open, and explored the shallow bottom. It was learned that Freddie does not perform or conform with authority in attendance, but that he preferred experimenting on his own. The mother understood his need, after a discussion, and she withdrew her urging for him to "swim" correctly.

At the final lesson Freddie was quite unmanageable in the water. He darted about. His arrogance and challenging attitude and remarks were my clues to keep the lesson "light." At one point he was told that perhaps he would like to allow a few weeks to elapse before coming for more lessons. He countered that "I'm going to get a new teacher and swim at Holiday Hill." He was encouraged to feel comfortable about making this change. On leaving, the instructor dropped a coin. Freddie picked it up and seemed unwilling to return it. It was suggested that he might keep it if he liked, but this in no way was a bribe for him to continue lessons with me. It was stated that it was important for him to feel he had the best teacher in his own estimation and liked her. He said he would make the change. Later, in a social situation at a mutual friend's home, he sidled up and said he wanted to continue lessons with me, that he really liked me, that I was a good teacher. The instructor told him she was glad. Freddie semed to be saying that he was glad he was not permitted to hurt me with his threat to change teachers. He seemed also to be testing me to see if I would reject him.

Freddie's mother refuses help from any source, in her disturbed relationship with Freddie, despite urging on the part of relatives who see a real problem. She will not agree that one exists. There are two older teen-age brothers. In this highly charged atmosphere of sibling rivalry, probably all one-sided, Freddie doesn't stand a chance. Relatives who spend time with him on week-end trips reported that Freddie will often say, "No one likes me." And in the swim-teaching situation, completely out of context, he remarked a few times, "I want to die." He pretended crying throughout each lesson, along with his varied antics.

The rather rapid acquisition of confidence in the water and his unreadiness to accept the new development, along with his need to still cling to the feeling that "I can't do it," emphasized the fact that he might be faced with his own need to say "I can't do it," despite growing loss of fear in the water. Since his acquisition of swimming skill came far too quickly and apparently proved too overwhelming for his feelings of inadequacy, it was suggested to his mother that Freddie needed to adjust to his gains and recommendation was made to discontinue lessons until a later time. There is no doubt that Freddie will swim quite easily in time. He is natural in the water. The intercession of cold weather closed the contact.

A middle-aged, youngish grandma met her first four lessons with copious gagging, belching, coughing and embarrassment at her behavior. Her anxiety and fear of water was unremittingly brought up as a challenge, that it would be a miracle if she learned to swim. In eight lessons, this pupil was swimming easily, with assurance and a real understanding of her limitations. She is now at home in the water and feels pride in her accomplishment. She is quite relaxed in the water.

Alice, a registered nurse and mother of a teen-age boy, came for lessons. She felt compelled to let one foot rest at the bottom of the pool. The other foot floated freely. When the writer held up her hands in support of a face-down float, she easily brought both legs to the surface and then continued to maintain the float by herself. Each lesson was preceded with this almost ritualistic pattern and invariably the remaining foot hugged the bottom of the pool. She felt this was something she would never overcome. The instructor did not enter the water until this pupil gave up her attempt to go in by herself

and test her ability to float both limbs on the surface of the water. This she insisted upon and then the lesson would start in earnest. Towards the end of each lesson, the pupil would remain in the pool by herself with the instructor issuing instructions from the side of the pool. By this time, she would have overcome her initial fear and towards the end of the session, would be thrashing about with her feet not touching the bottom, except for standing purposes.

Alice's real lack of inner freedom was apparent as she was observed in the water .There are beginners who, despite their fear, display an initial daring and will venture or fling themselves out in the water in a reckless abandon. The postural hump between her shoulders effected a gnome-like appearance. Her arms and legs would venture out in quick thrusts and inevitably she would resume her overall foetal-like position and quality. Apparently, my observation was intuitively correct. She was switched to a dog paddle which did not permit a wide excursion of arms and legs and she immediately relaxed and lifted both feet off the bottom. She paddled away comfortably and smilingly, as though this was It. Outside the pool, I observed this pupil's tightly compact, rigidly encapsulated, diminutive personality. She talked with an amused twinkle in her eyes and they seemed to hold a secret, possibly a wish to reach out, stretch out. Her gamin haircut added to her child-like elfin quality and her body tautness belied a relaxation she earnestly seemed to yearn for. She literally begged for freedom and escape.

Alice was intelligent and quick. The instructor was able to interpret the inner tensionless feelings necessary for buoyancy. By example, a dancing leap into space was demonstrated, with the torso arched, almost as a bird in flight. To further demonstrate, Alice was asked to lift out her rib cage as far from the pelvic structure as possible. For the first time she was able to spot the bodily mechanism, at least, that could free her physically from her immobilization. She caught on very quickly.

Later, a swan dive off the board was demonstrated. This abandon of the body and spirit to space she caught in its essence and soon tried to emulate its freedom in the water. She repeated, "I'll get it yet, I'll get it." The instructor's emphasis was that this kind of reaching out must be experienced in the water, to enable her to swim pleasurably as well as safely. She caught its implications and made it her goal—"To be able to experience such freedom, is it really possible in water?" At one point, Alice countered with "You say things so glibly, it isn't as easy as that; you can't fool me." Her posture epitomized the subservience with which she faced life in general.

At a receptive time, her posture was discussed, and she agreed that body posture work with another teacher could be helpful and that she could then return for her swimming instruction later. She confided that she had been in analysis and would sometime like to return to it. Her husband and boy likewise had received therapy in the past. Her entire outlook suggested a desire to "start a new life" from within and from without and to take herself in hand. She felt warm and close to the instructor and one evidence of her gratefulness took the form of repeating a payment for four lessons, to which her attention was called. Alice returned the next summer and swam. Her remark that her husband tries to destroy her emotionally and her pronounced body language gave the clues.

It is the writer's opinion that deeply set personality patterns are apparently shaken loose and could be rendered more accessible for the psychiatrist to reach and ameliorate, as the preceding histories seem to demonstrate

It is apparent, as well, that since each person presents the challenge of his own unique personality and body language, this technique of swimming instruction cannot be readily utilized for group teaching, unless the skills of the instructor become as facile as that of the psychiatrist in group therapy.

Are the unsatisfied inner drives of the human and his guilts the immobilizer in water? There seems to be a complete unawareness in some disturbed people of the sense of well being they can gain through using their bodies skillfully and how this feeling can merge into other areas of their personality structure. However, Alice was aware. She yearned for the full use of her body and was seeking help through both psychotherapy and swimming lessons.

It has also been observed that many people feel that they do not deserve to enjoy this pleasure in water, that their guilt and anxiety block their paths to learning. Is this not similar to how patients reveal in psychotherapy their yearning to enjoy pleasures, *i.e.,* life, but cannot overcome their guilt that remains the obstacle?

There seems also to be some transference value in this method of teaching swimming. In some cases there also seems to be a loosening up of other areas of repression in the pupil's life, when this basic fear of death in water is overcome. Natural body ryhthms are re-established and new ones are learned, making the person feel a more integrated being.

While no reference in this paper has been made to the efficacy of this specialized approach for the

restraining of neuromuscular skills with the physically regressed or handicapped patient, it is apparent that this specialized approach can be equally and successfully applied to the total person.

Focus of this presentation has been based primarily on method of treating inhibited beginners in swimming, using techniques which involved dependency, true relationship, insights, intuition and understanding body language and perspective of movement to produce a relaxed, happy swimmer who enjoys his experiences.

FATIGUE — Cont'd from Page 117

14. Dill, D. B., . H. Talbott, and H. T. Edwards, Studies in Muscular Activity—VI: Response of Several Individuals to a Fixed Task. *J. Physiol.*, 69: 261-305, May, 1930.
15. Eichna, F. W., W. B. Bean, and W. F. Ashe, Comparison of Tests of Physical Fitness. Project No. 5, Subproject No. 5-29, Army Ground Forces Medical Research Laboratory (Army Medical Service Field Research Laboratory), Fort Knox, Kentucky, March 10, 1944.
16. Erickson, E., E. Simmons, H. L. Taylor, H. Alexander, and A. Keys, The Energy Cost of Horizontal and Grade Walking on the Motor-Driven Treadmill. *Am. J. Physiol.*, 145: 391-401, January 1946.
17. Graybiel, Ashton, and H. West, The Relationship Between Physical Fitness and Success in Training of U. S. Naval Flight Students. *J. Aviation Med.*, 16: 242-249, August 1945.
18. Johnson, R. E., H. T. Edwards, D. B. Dill, and J. W. Wilson, Blood as a Physiochemical System—XIII: The Distribution of Lactate. *J. Biol. Chem.*, 157: 461-473, February, 1945.
19. Kark, R. M., H. F. Aiton, E. D. Pease, W. B. Bean, C. R. Henderson, R. E. Johnson, and L. M. Richardson, Tropical Deterioration and Nutrition, Clinical and Biochemical Observations on Troops. *Medicine*, 26: 1-40, February 1947.
20. Margaria, R., H. T. Edwards, and D. B. Dill, The Possible Mechanisms of Contracting and Paying the Oxygen Debt and the Role of Lactic Acid in Muscular Construction. *Am. J. Physiol.*, 106: 689-715, December 1933.
21. Mayo, Elton, *The Human Problems of an Industrial Civilization*. Boston: The Macmillan Company, 1946.
22. Morris, M. H., Does Sports Equal Fitness? *The New Republic*, 136 (17): 14-15, April 29, 1957.
23. Phillips, B. E., The Relationship Between Certain Aspects of Physical Fitness and Success in Pilot Training. Project 500-1, Report No. 1, School of Aviation Medicine, Randolph Field, San Antonio, Texas, June 1947.
24. Rice, Hugh A., and A. H. Steinhaus, Studies in the Physiology of Exercise—V: Acid-Base Changes in the Serum of Exercised Dogs. *Am. J. Physiol.*, 96: 529-537, March 1931.
25. Robinson, S., H. T. Edwards, and D. B. Dill, New Records in Human Power. *Science*, 85: 409-410, April 23, 1937.
26. Slowstaff, B., Ueber die Beziehungen zwischen Korpergrosse und Stoffverbrauch der Hunde bei Rude und Arbeit. *Pfluger's Archiv.*, 95: 158-191, March 1903.
27. Taylor, C., and R. Franzen, Measures of Exercise Tolerance. Report No. S7, Civil Aeronautics Adm. Div. of Research. Stanford University and New York University, February 1946.
28. Taylor, H. L., A. Henschel, J. Brozek, and A. Keys, Effects of Bed Rest on Cardiovascular Function and Work Performance. *J. Applied Physiol.*, 2: 223-239, November 1949.
29. Taylor, H. L., L. Erickson, A. Henschel, and A. Keys, The Effect of Bed Rest on the Blood Volume of Normal Young Men. *Am. J. Physiol.*, 144: 227-232, July 1945.

NAMH ANALYZES MENTAL HOSPITAL STATISTICS

Mental hospital rolls showed a slight drop at the end of 1958, continuing a three-year downward trend, but at the same time, admissions to these hospitals rose sharply, the National Association for Mental Health said in its Annual Report issued in June.

Resident patients in state and county mental hospitals stood at 545,000 on December 31, 1958, compared to 548,000 at the end of 1957, a reduction of approximately one-half of one per cent. Admissions in 1958 were 210,000 compared to 195,000 in 1957—a rise of about eight per cent.

The net fall in the resident population of the state and county hospitals in face of the steep increase in admissions indicated, according to the report, that "more patients are getting more treatment." However, the report warned, it is primarily the new admissions that are being helped and discharged. The great majority of the old patients, says the report, "are getting little or no treatment at all."

The quality and quantity of treatment mental patients get depends on the adequacy of staff and treatment facilities in the hospitals, the report remarked. When rated according to minimum standards set by the American Psychiatric Association, few mental hospitals are shown to be giving their patients the treatment they need, the association asserts. Of the 228 mental hospitals and institutions inspected by the American Psychiatric Association by the end of 1958, only 34 were approved. Sixty-six had been given only conditional approval and 109 were disapproved. Reports on the remaining 19 had not yet been released at the time the mental health association's annual review was being written.

The report listed several other important developments during 1958:

1). Dr. Franz J. Kallmann of the New York State Psychiatric Institute, in attempting to isolate the hereditary bodily factor which makes some people vulnerable to schizophrenia, narrowed down the search to an enzyme which regulates the metabolism of blood cells. In patients suffering from schizophrenia, Dr. Kallmann found, this enzyme acts abnormally, and this, it is now believed, may impair the ability of the blood cells to take up and transmit to the nervous system substances it needs for proper functioning. This deficiency could account for the inability of these persons to withstand certain stresses, precipitating the onset of the disease.

When it is definitely established that this misbehaving enzyme is responsible for the lower efficiency in dealing with stress, then it should be possible to compensate for it and to restore normal blood cell metabolism, preventing the development of the disease, the report states.

The work of Dr. Kallmann is part of a 26-project research program in schizophrenia conducted and financed for the past 25 years by the Scottish Rite Supreme Council in cooperation with the National Association for Mental Health.

2). The "open hospital" policy which gives patients freedom of buildings and grounds, and in many instances, freedom to visit surrounding communities, continued to spread across the country, with increased evidence that removal of restraint alleviates symptoms and speeds recovery.

3). The number of community mental health clinics increased during the year, primarily as a result of the operation of statewide Community Mental Health Acts which encourage, and in many cases help to finance local mental health facilities for treatment, rehabilitation and education. States operating under such acts during 1958 were California, Connecticut, Florida, Indiana, Minnesota, New Jersey, New York, Pennsylvania, Tennessee, and Vermont.

4). Federal government appropriations for research, training and community services rose substantially in 1958. Congress appropriated $52,000,000 for the budget of the National Institute of Mental Health, compared with $37,000,000 in 1957.

A TRIBUTE TO THE MEMORY OF ALAN GREGG*

JOHN E. DAVIS, SC.D.**

(Dr. Alan Gregg died June 19, 1957 at his home in Big Sur, California. He would have been 67 years old on July 11 of that year).

In an editorial on November 3, 1956, *The New York Times*, referring to Dr. Gregg as "public health statesman, influential medical educator and wise counsellor" said: "There are millions of persons throughout the world whose well-being has been materially improved by the efforts of Dr. Gregg. Medical education and research in our nation has been significantly enriched by his enquiring mind and mature philosophy." It is most fitting that The Association For Physical and Mental Rehabilitation which has so frequently felt the stimulus of his guidance should pay this tribute to his memory.

The source of my information comes from rather close personal relationship over a period of twenty years, material as to his many interests and activities from his wife, Eleanor B. Gregg, contributions from The Rockefeller Foundation, various medical and other professional societies in recognition of his significant and often pioneering services, his autobiography in *Who's Who in America* and readings from his masterly writings covering a wide gamut of medical education, world association, human progress and betterment.

A true statement of Dr. Gregg's accomplishments reflects the rare beauty of a great and noble service to mankind. His main interests in the field of medicine were devoted to medical education in Europe and the United States, public health and psychiatry. During his latter years he became interested in the ecology of medicine. His last contribution titled *For Future Doctors* was published by The University of Chicago Press after his death.

Dr. Gregg was a man of many interests. His brilliance lighted up many areas which only a social scientist discovers and critically examines. He was interested in cycles, especially the study of rings in relationship to growth and age. He was an unusually ardent and well informed conservationist of soil, water and plants and an enthusiastic member of "Save the Redwoods League." Population problems were always active in his enquiring mind involving such related studies as turning fresh water into salt. A life long interest in pigeons led to extensive studies of their moulting and breeding. The subject of genealogy was included in the extent of his active interests, and he accumulated and sifted out quantities of material relating to his and his wife's families.

Dr. Gregg's ever consuming interests were for human betterment, and he literally burned out his life in this relentless ambition. It is rare indeed, to find such social zeal harbored in an analytically scientific mind, and it was this unique combination that set him apart from his fellows, and made his contribution ever significant and lasting. To the host of people everywhere who have heard of the name of Alan Gregg but have not met him personally his writings become the picture of the man. Masterly diction, marked originality in sentence structure, keen and sharp illustrations create a writing finesse which at times approach poetic beauty as was his "Humanism and Science" which he gave before the New York Academy of Medicine, February 1941. There is probably no article in current medical literature more highly regarded as an example of the finest classical writing.

Dr. Gregg's rare facility for written expression was perfected only through persistent and painstaking effort. Allow me to cite a personal instance. Dr. Gregg was invited to deliver a talk before the national meeting of our Association, in Memphis, Tennessee, in 1950. In the face of an overwhelmingly busy schedule, he agreed. On one of his frequent visits to Washington, D.C., he requested that I meet and go over his paper with him in order to get my reaction as to its pertinency for presentation before our Association. The paper was titled "The Beginnings of Health" and was his usual brilliantly penetrating picture of a medical topic. He discussed the emergent role of the corrective therapist in the new world of progressive medical practise, the originality and promise of this activity-psychological approach to the sick and disabled. I listened carefully as he read and could find nothing to criticise but much to admire. I was naturally struck with the significant role he had discovered for the corrective therapist. I was amazed at his originality in the selection of words and paragraph structure. The promise and encouragement emerging from such an authoritative viewpoint were especially encouraging. On former occasions, Dr. Gregg had gone to considerable pains to assist me in improving my writings. His personality radiated the spirit of helpfulness, and it was only natural that I asked questions along these lines: "Dr. Gregg," I ob-

*Presented at Third Tri-Organizational Conference, Miami Beach, Fla., July, 1959.

**Executive Director, Association for Physical and Mental Rehabilitation.

served, "one can only be amazed at your ability to keep away from all stereotyped expressions; there is so much freshness and originality in your words, your diction is flawless, I can't understand how you do it."

"It is not merely a gift," he replied. "I rewrite at least seven times every article I present in a talk of this type."

This statement to my mind uncovers one of the rare ingredients of the mechanics he followed which contributed to the wealth of classic writings he left to posterity.

Dr. Gregg was most naturally attracted to births of new ideas and movements which contained elements of promise for human betterment. It is only proper that our Association should acknowledge our indebtedness to him for constant and consistent counsel. His mature advice was a most important aid to the initial organization of the Association's educational, certification and accredititation standards and procedures. One of the busiest of men, he always found time to bestow the benefit of his wide and knowledgeable experience, even to the extent of the working out in detail a medical panel discussion for a national meeting of our Asscociation. Dr. Gregg was too busy with the affairs of others to concern himself with his personal comfort. He literally burned himself out in response to a noble sense of dedication to mankind. In my own mind, I have often compared his life to that of the late Secretary of State Dulles in his messianic fervor to protect and and serve mankind

As an example of Dr. Gregg's interest in The Association for Physical and Mental Rehabilitation and its professional development and growth, allow me to read a letter from him under date of March 9th, 1951. This letter was in response to a request for a statement we might include in an article entitled "The Adolescence of Corrective Therapy."

As the conditions of our lives and living constantly change, new professions and callings come into being. The profession of electrical engineering hardly existed a hundred years ago. Indeed, hardly a decade passes in some of our universities that does not witness the establishment of a new school or institute for the training of recruits to some new or young profession or calling—public health, aeronautic engineering, electronics, biophysics, to cite but a few.

In some ways a new and growing profession can be said at a certain point to be in the adolescent stage of growth. We all know adolescents. They are often a headache and just as often a heartening surprise. They show awkwardness and acute self consciousness. They are unpredictable. What they do not exaggerate they ignore, neglect or omit entirely from their reckoning. They scorn patience, compromise, tolerance of others and the long view. They rear and plunge and sometimes shy at trifles. They make passionate assertions and violent objections. But despite all these oddities of conduct they put within themselves unfolding abilities and nascent power, and their minds and hearts are in the future. Their hope, their confidence in their subject is unbounded and their confidence in themselves steadily increases. When a profession is adolescent it is interesting, inviting and alive, full of potentialities, of errors, hits and runs.

This was Dr. Gregg's wise appraisal of the promise for Corrective Therapy in its early developmental years.

Dr. Gregg was a most practical man but he combined with this down-to-earth approach a stirring idealism which in his dealings with people created what Adolf Meyer often referred to as "an infectious atmosphere." Standing ahead, he beckoned people on, and his motivation was never the pushing kind. He looked upon the word rehabilitation as an optimistic term and often quoted the following statement of John Galsworthy (1):

Body and spirit are inextricably conjoined; to heal one without the other is impossible. If a man's mind, courage and interest be enlisted in the cause of his salvation healing goes an apace, the sufferer is remade . . . A niche of usefulness and self respect exists for every man however handicapped but the niche must be found for him. To carry the process to a point short of this is to leave the cathedral without the spire . . . Let us treat him as if he were ourselves, let us treat him as one who demands a full place in the ranks of working life and try to find it for him . . . to restore him and with him the future of our countries, that is the sacred work.

Dr. Gregg's great service was in a major way a part of the Rockefeller Foundation. He joined the Foundation as a member of the International Health Division Field staff in 1919. From 1922 through 1928, he served as Associate Director For The Medical Sciences and from 1930 to 1951 as Director for The Medical Sciences. From May 1951 until his retirement on June 30, 1956, Dr. Gregg was Vice President of the Foundation. Dr. Gregg's character, wisdom and broad knowledge touched so many areas of medicine and life that it is difficult to point out a major contribution. The Rockefeller Foundation appraises his contribution to psychiatry stating that his greatest effort was directed toward improving the position that psychiatry occupies in the hierarchy of medicine and that the idea, basic to psychiatry, that mental illness is a disease which must be treated in the same spirit and often by the same methods as other sicknesses, has become widely accepted through the work of Alan Gregg.

Never a person to seek personal gain or egotistic recognition, Dr. Gregg nevertheless received many honors during his lifetime. In 1956, The American Health Association singled out Dr. Gregg for unusual recognition by choosing him for a special Albert Lasker Award. Only three such awards have been made since they were founded ten years ago. The citation, naming Dr. Gregg "Elder Statesman to science as a whole" read in part: "No man in our time has more benignly influenced individual scientific

endeavor or more importantly and wisely influenced the development of medical education and of scientific aspirations and standards than has Alan Gregg . . . It is indeed fortunate that he was drawn early to the practise of public health and to the administrative side of scientific endeavor with The Rockefeller Foundation . . . Constantly appealed to as counselor by national leaders and scientific bodies, he has never been too busy to give invaluable and friendly advice to the stream of scientists and medical educators, young and old, who have sought his guidance . . . Throughout his influential life he has sought to elevate the levels of professional education in public health which he has seen alongside psychiatry as cornerstones of medicine of the future." I might add that Dr. Gregg's interests and activities also extended into the developmental areas of the paramedical disciplines including psychology, social service, nursing, and the companion therapies of physical medicine and rehabilitation, physical therapy, occupational therapy, corrective therapy, manual arts therapy and educational therapy.

Allow me to close with a tribute to Alan Gregg written by Mary E. Irwin, sister of Mrs. Alan Gregg:

We mourn the loss of one who is widely honored and deeply loved, a warm hearted, beauty-loving man with exceptional gifts of friendliness and insight. His conception of "being decent" was to give full attention to a stranger's needs, and many have drunk from "his cup of strength." As he dispersed and apportioned Rockefeller funds, his efforts were tireless, whether he rescued scores of Jewish scholars from Hitler's grasp, aiding talented but ill equipped scientists throughout the world, or envisaging and endowing large-scale research. He was singularly uncompetitive, careless of honors and acclaim for himself, eager only to be useful. Though incensed by injustice, racial discrimination and war and deeply saddened by pettiness and greed, he never lost his love and enthusiasm for the human race. And he is still living on in countless (and she quotes George Eliot's *The Choir Invisible*)

. . . pulses, stirred to generosity,
In deeds of daring rectitude, in scorn,
Of miserable aims that end with self,
In thought sublime that pierce the night like stars,
And with their mild persistence urge men's search,
To vaster issues.

REFERENCES

1. Galsworthy, John from Foreword to the Proceedings of the Second Annual Meeting of the Interallied Conference on the After Care of the Disabled Men, London, May, 1918.

DR. TUCKER HONORED

A Veterans Administration medical leader in the field of tuberculosis has been chosen to head the American Trudeau Society, medical section of the National Tuberculosis Association. New president-elect of the society is Dr. William B. Tucker, director of tuberculosis service for the VA in Washington, D. C. He will take office in 1960.

Dr. Tucker was chairman of the committee on plans for the VA-Army-Navy Conference on Chemotherapy of Tuberculosis from 1948 until his appointment to the Washington position in 1956. He entered the VA in 1947 as chief of the tuberculosis service of the Minneapolis, Minn., VA hospital, and in 1954 he was transferred as chief of the pulmonary disease service of the Durham, N. C., VA hospital. During this time he held appointments as professor of medicine at the University of Minnesota and at Duke University.

FREEZING PRESERVES BONE MARROW

Successful preservation of living bone marrow cells in a frozen state for life-saving use in persons exposed to radiation has been announced by Veterans Administration. The accomplishment by a research group at the Long Beach, Calif., VA hospital will for the first time make possible bone marrow storage in hospitals, VA said.

Dr. Nathanial B. Kurnick, chief of the VA hospital's hematology service, who heads the group, said intravenous injection of the stored marrow has produced dramatic improvement in low blood counts of cancer patients following radiation therapy and could be equally useful for persons exposed to radiation injury in nuclear accidents.

Dr. Kurnick said the marrow stored and administered to the cancer patient following radiation therapy is the patient's own. Because of the immune reaction which each human being develops against the cells and tissues of others, doctors have not been able to transplant healthy bone marrow cells from one person to another except in identical twins.

Bone marrow was taken from four cancer patients at the hospital. The marrow was slowly frozen in glycerol to keep ice crystals at a minimum and was maintained at minus 79 degrees Centigrade. In this manner, the living marrow cells may be stored for at least a year and perhaps indefinitely, Dr. Kurnick said.

After radiation therapy, when the patients' blood showed a dangerously low level of vital elements because of injury to the bone marrow, the preserved marrow was brought back to normal temperature and injected. No adverse reactions to the injections were noted, Dr. Kurnick said.

Dr. Kurnick said vigorous growth of new bone marrow cells was noted within weeks after the injections and blood counts returned to nearly normal within a month to six weeks. This was surprising because experience shows that bone marrow injuries, even if much less severe, are ordinarily recovered from very slowly, he said. With use of the injection of stored marrow, cancer patients can be treated much more intensively with radiation than has been thought advisable in the past, Dr. Kurnick believes.

The study was supported in part by a grant from the United States Public Health Service.

DR. COHEN APPOINTED

Appointment of Dr. Irvin J. Cohen as Veterans Administration assistant chief medical director for planning has been announced by VA. Dr. Cohen will succeed Dr. William W. Fellows, who retired from Government service March 26.

In his new post, under the VA Chief Medical Director in Washington, D.C., Dr. Cohen will direct planning of the medical care program for VA's 171 hospitals, some 100 outpatient clinics, and 17 domiciliary homes.

He has been a deputy director for planning to Dr. Fellows since August 1958, and previously was director of hospitals and clinics for VA in Washington, D.C., for three years.

In recognition of his contribution to VA's medical programs, Dr. Cohen was presented the Meritorious Service Award by Administrator of Veterans Affairs Sumner G. Whittier in January 1959.

DR. STRAWS CITED

The Veterans Administration Chief Medical Director's Commendation, highest award given by the VA Department of Medicine and Surgery, has been presented to Dr. Erwin W. Straus of the agency's Lexington, Ky., hospital.

Dr. Straus was cited for his outstanding contributions to the VA patient care and medical research programs and for his contribution to psychiatry through his writings, lectures, and exhibits. As director of the research and education service of the Lexington hospital, he has worked closely with the VA's large-scale cooperative studies of chemotherapy in psychiatry since these were begun in 1954.

He also is engaged in extensive research of his own, studying expressions, gait, gestures, and other behavior of mentally ill patients.

FROM YOUR PRESIDENT

Fellow Members:

It has been said that one of the greatest honors which can be bestowed upon a man is that he be selected by his professional co-workers for the presidency of their association. Let my first words to you be those of gratitude for bestowing this honor upon me. This is a most dedicated association, and the work of its members bespeaks its membership's regard for human values. To be president of an association which is dedicated to serve those less fortunate than ourselves makes the tribute even more significant.

The power and prestige which our association now enjoys reflect greatly the loyalty and the devotion of my industrious predecessors and the contributions of their talents to its cause. Yet I have complete confidence, despite my own limitations, that this administration will measure up to and will carry on in the same tradition.

The professional and administrative growth and development of any organization, regardless of size, is dependent on its committees' and chapters' activities. Likewise, the strength and growth of our association can be measured in direct ratio to the functions of our association's committees and chapters. Strong committee leadership and membership participation in committee activities when requested are the ingredients required for continued growth of our organization. Recommendations, surveys, reports and newsletters are the life blood of any organization. In this *Journal* can be found the names of all standing and administrative committee chairmen. Your continued support and increased participation in committee activities and chapter development will reflect itself in our continued progress. The association is *you!*

In addition to our association's stated objectives, which your officers will make every effort to elevate and perpetuate, with your assistance emphasis will be placed on the following:

1. Increase national membership. This administration's sincere and realistic objective is to increase our membership rolls by at least eighty members. If each chapter would sign only seven new members, this realistic goal would be exceeded.
2. Increase chapter memberships.
3. Increase chapter participation in all association affairs.
4. Solicit membership to increase the number of articles submitted for journal publication.
5. Enlist the aid of each chapter in securing journal advertisements.
6. Through the public relations committee, contact all colleges training physical educators to inform these schools of our association and its contributions to the field of education and rehabilitation. This information will include required qualifications for work in corrective therapy, membership requirements, and method of attaining certified status.
7. Through the liasion committee, with your assistance, determine the number and place of private employment of corrective therapists.

These are but of few of the projects your president and other members of the executive board will attempt to complete during their tenure.

At the board of governors meetings in Miami Beach, Florida, your representatives selected John E. Davis, Sc.D., to fill the sorely needed and newly created position of executive director of the Association for Physical and Mental Rehabilitation. Dr. Davis needs no introduction from me, as his years of devotion and work in the field of corrective therapy is well known to all of us. Our association is indeed fortunate in acquiring the services of our founder and retired VA Central Office chief. Being a past president of our association, Dr. Davis has intimate knowledge of our problems. His services to the association will be invaluable.

At this same meeting your representatives saw fit to remove the position of certification committee chairman from a selected position to one of election by the board of governors with status as an executive board member.

These are but a few of the changes enacted at our recent meeting in Florida. These business meetings were well attended, and the results reflect the serious and energetic considerations given to all proposals and problems. In the near future, you will be given detailed reports of these meetings and their results.

In closing, I again want to express my gratitude for placing your confidence and trust in me. I have accepted this appointment with pride, but also with a sense of humility. I am fully aware of the responsibilities and importance of this position, and I cherish the opportunity to serve — with your cooperation, guidance, and counsel.

Norman N. Tenner, C.C.T.
President

"From Other Journals"

Unless noted otherwise, all abstracts have been prepared by Philip J. Rasch, Ph.D.

Kari T. Neubuerger, David W. Sinton, and John Denst, Cerebral Atrophy Associated with Boxing. *AMA Archives of Neurology and Psychiatry*, 81:403-408, April, 1959.

Mental deterioration in "dementia pugilistica" would be expected to have an anatomical basis. The cerebral alterations are believed to be thixotropic in origin, that is "a disturbance of the gel-sol equilibrium caused by shaking, stirring, ultrasound, or other mechanical features." Concussion produces a change in the colloid medium of the cerebral tissue. This involves all of the brain, not merely circumscribed areas. Trauma may produce a liquefaction of gels, which may or may not be reversible. It is conceivable that multiple concussions over a period of years produce an altered state of the cerebral colloids, with inability to revert to the normal equilibrium. This process leads to precocious aging of the colloids, liberation of fluid, and shrinkage of the gels. Syneresis and hysteresis result.

Hans Duner, "Oxygen Uptake and Working Capacity in Man During Work on the Bicycle Ergometer With One and Both Legs." *Acta Physiologica Scandinavica*, 46:55-61, 1959.

Five healthy untrained men worked on the bicycle ergometer with one and with both legs. The oxygen uptake was practically the same in both cases, whereas if the size of the diffusion surface in the capillaries were the limiting factor, the oxygen uptake per pulse beat would be about twice as much with both legs as with one. The results indicate the limiting factor is the amount of oxygen distributed by the circulation to the muscles rather than the amount of muscle tissue taking part in the work.

Elmer L. Bingham, "Fractures of the Humerus from Muscular Violence." *U. S. Armed Forces Medical Journal*. X:22-25, January, 1959.

Only ten reports of fractures of the humerus due to muscle violence have been found in the English literature. Three more are discussed in this article. The muscles of the upper arm—primarily deltoid, supraspinatus, infraspinatus, and teres minor—hold the head of the humerus in a relatively fixed position of external rotation. The flexors attached to the lower part of the humerus—primarily coracobrachialis, biceps, and brachialis,—are in internal rotation. The resulting torsion on the shaft of the humerus produces a breaking force at the fulcrum of the fracture.

Henry J. Montoye, Wayne Van Huss and Marvin Zuidema, "Sports Activities of Athletes and Non-Athletes in Later Life." *The Physical Educator*, 16:48, May, 1959.

Data for this study was based upon questionnaire returns from 628 former college lettermen and 563 non-lettermen who attended Michigan State University during the same period. Prior to age 45 the former athletes showed a greater participation in some regular sports activity than did the non-athletes. This trend was reversed after age 45 with non-athletes showing higher percentages because of greater participation in non-competitive activities such as fishing, hunting, swimming or in golf and bowling. The athletes appeared to continue in vigorous sports activity until age 45 but did not substitute recreational activities thereafter.

Travis Winsor, Chester Hyman, and J. Howard Payne, "Exercise and Limb Circulation in Health and Disease." *AMA Archives of Surgery*, 78:184-192, February, 1959.

The distribution of blood to the extremities during rest and exercise has been subjected to much discussion. It is usually assumed that the arteries of the extremity can carry the extra blood required by exercising muscle without depriving the skin or other tissue. However, it has been suggested that in arterial occlusive disease the arterial blood supply is inadequate to meet the needs of exercising muscle and hence the use of exercise in the treatment of peripheral vascular disease may be harmful.

Studies of the circulation of the toes, foot, ankle, and calf were made in 50 normal subjects and 25 subjects who had arterial occlusive disease. These demonstrated that the normal artery can supply all of the blood needed by the exercising muscle without depriving any other tissue, but in patients suffering from arterial occlusive disease the increased circulation through an exercising calf results in relative ischaemia of the foot and toes.

L. G. C. E. Pugh, "The Adrenal Cortex and Winter Sports." *British Medical Journal*, 5118:342-344, February 7, 1959.

Eosinophil counts were made on healthy adults following skiing, channel swimming, running, and the Harvard step test. Exercise of short duration, even when carried to exhaustion, had little, if any, effect on the eosinophil count. Swimming, skiing, or running, when carried on for one or more hours, produced a large fall in eosinophils in untrained subjects, but had only a minor effect in fit subjects. This lessened effect is due to improved physical condition. Very prolonged exercise, as in channel swimming, was associated with a virtual disappearance of the eosinophils. This was accompanied by an eightfold increase in urinary corticoid output. These results were comparable with those obtained in major surgery. In a large variety of situations the degree of eosinopenia and its duration have been found to be related to the severity and duration of the stress. For practical purposes it can be regarded as an index of adrenal cortical stimulation.

Arthur L. Watkins, "Therapeutic Exercise in Rheumatoid Arthritis." *Arthritis and Rheumatism*, II:21-26, February, 1959.

Therapeutic measures employed in rheumatoid arthritis cannot be considered specific because of our lack of knowledge of etiology. The value of general rest has been stressed, but disuse has a destructive effect on functional activities. Exercise is necessary for the maintenance of metabolism. One study indicated that heavy resistance exercises had a protein-anabolic effect and decreased excretion of calcium. Imbalance of muscle power around a joint may upset mechanics and lead to deformity. Prevention of deformity and maintenance of joint motion are of value only as they lead to functional ability or skill. Exercise programs must be sighted on this practical level and set up on an individual basis. Verbal explanations and visual demonstrations by a therapist are necessary for the patient to learn how to perform the exercises. During the quiescent stage, PRE may be safely employed by rheumatoid arthritis patients under careful supervision.

Walter C. Alverez, "The Aged in a Changing Society." *Geriatrics*, 13:25-A-30-A, December, 1958.

According to Philip H. Vogt, older people who would in earlier times have happily retired on their farms are now forced to live in cities on inadequate incomes. In earlier days the older person would have died soon after retirement; now medical science keeps him alive, but he cannot find a job with which to support himself. The percentage of men aged 65 and over who are gainfully employed dropped from 68 in 1890 to 42 in 1950. Today the figure for both sexes is 25 per cent. Hardly 5 per cent of these have saved enough to be self-supporting. Thirty-six per cent of persons over 65 do not have enough income for a minimum budget, and 53 per cent have less than is necessary for decent living standards. Great efforts must be made to employ every person over 65 who is able and willing to work. The young worker must realize that he has to support those who do not.

Edward P. Reese, "Arthritis." *California Medicine,* 89:204-209, September, 1958.

In the treatment of arthritis heat relieves spasm and pain, dilates vessels, increases circulation, improves tissue metabolism, hastens absorption of exudates. It is applied before any form of exercise. Therapeutic exercises should be continued throughout the patient's life. They begin with passive exercise designed to increase the range of motion and prevent ankylosis and contracture. In assistive exercise the patient moves the part through the full range of motion. Resistive exercise is important in building muscle. Active joint inflammation does not contraindicate it; on the contrary strong muscles help support the weakened joint. Scheduled rest periods are necessary, but absolute bed rest is harmful. Trauma may be caused by overweight, by weight-bearing in unstable or flexed joints, by poorly fitting shoes, by poor posture, by occupational stress, or by psychic stress. A detailed progressive rehabilitation program should be formulated. The therapist should reassure the patient, impart enthusiasm, listen to his problems, gain his confidence, and allow him to ventilate his anxiety, anger, and hatred.

Book Reviews

Rehabilitation in Industry, edited by Donald A. Covalt (New York: Grune and Stratton, 1958, 154 pp., $6.00).

According to a study of 655 cases in New York State, less than one-half of Workmen's Compensation cases up for lump sum settlement were receiving rehabilitation services. In New York, between 35-40% of all compensable injuries are permanent, while in Ontario less than 4% are. It is further estimated that 80-90% of the cases referred to the NYU-Bellevue Rehabilitation Center would never have had need for such referral if the secondary complication following the injury were prevented by an early total rehabilitation program.

Reports such as these indicate a failure in the application of rehabilitation services. If this is due in part to inadequate appreciation of the rehabilitation approach, then this text is recommended as an excellent introduction to the comprehensive management of the individual accident patient. Included are chapters on P.V.D., fractures, amputations, peripheral nerve lesions, cord, head, back, hand and soft tissue injuries as well as vocational injuries. Since several sections are so brief as to do little more than to whet the appetite for more information, a near absence of bibliography in these sections is regrettable.

DJS

Physiotherapy in Obstetrics and Gynaecology by Helen Heardman. 2nd Edition. (Baltimore: The Williams & Wilkins Co. 1959 244 pp. $5.00)

Miss Heardman has carefully detailed techniques of posture, exercise, and relaxation useful in obstetrics and related them to various clinical states. Anatomy and physiology basic to understanding the normal pregnancy and puerperium are outlined. Although this book is intended for physiotherapists who use these methods to further a more natural childbirth and post-natal period, others who are concerned with these goals will find much useful information. Included are sections on lactation and breast feeding difficulties, restoration after Caesarean section, perineal lacerations, urinary retention, "after-pains," and subinvolution of the uterus. Preparation for labour stresses basic pelvic tilt and rocking exercises and the Jacobson relaxation techniques. A simple modification of the complex regimen advocated would probably be just as beneficial. The section on gynecology is not up to the standard set by that on obstetrics and cannot be recommended.

DJS

Primary Anatomy, by H. A. Cates and J. V. Basmajian. Third Edition. (Baltimore: The Williams & Wilkins Company, 1955. 339 pp. $5.75).

Basmajian states that in revising *Primary Anatomy,* originally the work of the late Professor Cates, he has sought to include material directed at students in physiotherapy, occupational therapy, physical education, health education, and nursing. One wonders why he omitted corrective therapy, since the text will certainly be of interest to them.

The corrective therapist has constant need for a good reference book in anatomy, but generally finds texts such as those of Gray and of Boyd *et al.* too detailed, too bulky, and too expensive for his requirements, in addition to which they usually are lacking in a satisfactory description of muscle actions. In the book under consideration the chapter on the muscular system, which is the area of greatest interest to the corrective therapist, is by far the longest, and the subject is treated largely in the manner of kinesiology texts, that is, the origin, insertion, action, and innervation of each muscle is clearly set forth. Basmajian's own researchs in electromyography have enabled him to make several personal contributions to this part of the book.

Nine systems are recognized — skeletal, articular, muscular, digestive, respiratory, urinary, reproductive, circulatory, and nervous—in addition to which separate chapters are devoted to an introduction, the eye, the ear, and the skin and endocrine glands. For a text book, it is unusually easy to read. Occasionally an unusual word appears, such as triquetrum to designate what is more commonly known in the United States as the triangular or cuneiform bone, but this is seldom bothersome. An excellent feature is found in the fact that a translation of Latin or Greek terms usually accompanies the first presentation of the word.

The book is profusely illustrated. Something over 440 illustrations—almost entirely consisting of line drawings—are included, of which over one-third are said to be new with this edition. An index is supplied, but rather surprisingly there are no bibliographic entries.

It is good to see anatomy defined as "a science of the living," as all too often the student comes to think of it as pertaining only to the cadaver. On the basis of content, size, and price, *Primary Anatomy* is enthusiatically recommended to the corrective therapist seeking a useful text in its field.

PJR

Body Building, by Martin S. Dworkin. (New York: The Ridge Press, Inc. Distributed by Sportshelf. 1958. 64 pp. Paper. 50c.)

This is a very simple little manual designed for the use of high school boys who are interested in weight training. Most of the standard exercises are described in language free from technical terms, and the text is accompanied by numerous photographic illustrations. Exception might be taken to some of the directions. Practice of the straight arm pull over is very apt to result in sore elbows, and the exercise is more effective with the feet on the bench than with them on the ground. In the bent arm pull over the elbows should be kept fairly close to the head. There is no conceivable reason for performing bench presses with the head off the bench. With these minor exceptions, the text should be entirely satisfactory for its purpose.

PJR

The Treatment and Prevention of Reading Problems, by Carl H. Delacato. (Springfield: Charles C Thomas, 1959. 122 pp. $4.50)

This small book approaches reading problems from the point of view that a strong neurological dominance must be established in order for reading skills to develop. A detailed system for achieving this dominance is explained and described. If the case histories cited are not handpicked, the dramatic results of this system deserve the careful consideration of all who work with the language handicapped.

NWF

Improvement of Physical Performance Through Weight Training. (Berkeley: California Interscholastic Federation, January, 1959. 27 pp. Mimeographed.)

In 1957 the California Interscholastic Federation established a Youth Fitness Committee to study the extent to which weight training contributes to fitness and is practiced in California high schools. The Committee's report turns out to be propaganda designed to promote weight training in high school rather than an investigation of its stated problems. It starts by defining weight training as "a well-planned program of physical exercise;" a *Saturday Evening Post* article on Paul Anderson is described as "inspiring;" *Strength & Heath* is said to contain a "great number of fine articles" and to be "*the* pioneer in this field"—which it was not. There is a section devoted to interviews with individuals in favor of weight training, a list of prominent athletes who have trained with the weights, a copy of the questionnaire sent out, suggestions for organizing a program, and a bibliography. The committee was evidently unfamiliar with the studies of progressive resistance exercises which have appeared in this *Journal* and other medical publications. The reader will, of course, look in vain for any consideration of the implications of the fact that Santa Monica recently found it necessary to bar weight training from "Muscle Beach." The report possesses no value as a critical investigation of weight training. It is surprising that such an unacademic paper would have been accepted by such a group.

PJR

News and Comments

VA PUBLISHES CONFERENCE REPORT ON AGING

A forward look at medical research of the future to prolong health and happiness for the aging population is available in a new Veterans Administration publication. Titled "VA Prospectus, Research in Aging," the book pools the knowledge and thinking of a group of the nation's outstanding leaders in medical research in the field of aging.

The contents are a compilation of material from a meeting of the VA Advisory Committee on Problems of Aging, distinguished guests, and VA Department of Medicine and Surgery staff members. The book is divided into five presentations, each followed by discussion:

Aging of Molecules—Aging and Ground Substance of Connective Tissue, by Isidore Gersh, Ph.D., professor of anatomy at the University of Chicago School of Medicine, with discussion led by Wendell H. Griffith, Ph.D., professor of physiological chemistry at the University of California at Los Angeles School of Medicine.

Aging of Cells, by Robert J. Boucek, M.D., chairman of the Department of Cardiovascular Disease at the University of Miami School of Medicine, with discussion led by Albert I. Lansing, Ph.D., professor of anatomy at the University of Pittsburgh.

Aging of Organs—Aging and the Nervous System, by James E. Birren, M.D., chief of the Section on Aging of the National Institute of Mental Health, with discussion led by Ralph W. Gerard, M.D., Ph.D., professor of neurophysiology at the University of Michigan and chairman of the VA Advisory Committee on Problems of Aging.

Aging of Individuals—some fundamental aspects of the aging process, by Charles F. Geschickter, M.D., professor of pathology at Georgetown University School of Medicine, with discussion led by Eugene M. Landis, M.D., professor of physiology at Harvard University School of Medicine.

Aging of Groups, by Jack Weinberg, M.D., attending psychiatrist at Michael Reese Hospital in Chicago, with discussion led by William D. Stroud, M.D., professor of cardiology at the University of Pennsylvania.

The summary of the conference, by Wilburt C. Davison, M.D., dean of the Duke University School of Medicine, also is included.

COOLING TECHNIQUE AIDS CARDIAC SURGERY

Development of a new method of body cooling that makes possible prolonged surgery inside the heart has been announced by the Veterans Administration. In contrast to previous methods that allow the surgeon only six to eight minutes to work inside the heart, the new technique assures greater safety for the patient, sets no time limit for the surgeon, and gives opportunity for much better repair of intricate heart defects, VA said. Devised by Dr. Frank Gollan of the Nashville, Tenn., VA hospital, the new method involves circulation of oxygenated and refrigerated blood through the main arteries of the body by use of a heart-lung machine.

Hypothermia, or reduction of body temperature, is used for patients in heart surgery to slow heart action and blood circulation and thus give the surgeon a field clear enough for operation, Dr. Gollan explained. The general method of lowering body temperature of a patient for heart surgery is by placing him in a tub of cold water or in a rubber blanket through which ice water circulates. Such external methods of producing hypothermia have the disadvantage of permitting only a short period of interrupting blood circulation and thus give the surgeon only six to eight minutes to work on the heart. If such methods of cooling are used for a longer period, blood does not flow evenly in the small blood vessels and vital organs such as the heart and brain are damaged from lack of oxygen.

While external methods of producing hypothermia cool the skin first and are accompanied by disturbances of blood flow, the method devised by Dr. Gollan cools the internal organs first and at the same time supplies an adequate flow of blood to cover the oxygen needs of these vital organs. It permits the surgeon to operate inside the heart while the heart is beating and thus he can see as well as test the functions of the heart valves on which he is operating.

Oxygenation, pumping, and refrigeration of blood are combined in one small plastic cylinder in the new heart-lung machine—three functions that require several cumbersome large instruments in other heart-lung machines.

Dr. Gollan has been developing the new method and new heart-lung machine in research with animals at the Nashville VA hospital for the past eight years. Recently surgeons at Duke University and the Mayo Clinic have used the technique on humans.

In his research, Dr. Gollan considered the fact that when the skin, subcutaneous tissue and muscles are cooled first, most of the body weight is cooled, including parts that can stand lack of oxygen for a considerable length of time and do not need to be cooled for heart surgery. Therefore, he shifted the cooling process to the vital internal organs that make up only a small percentage of body weight and need only about half of the total blood supply.

OK 125,050 BEDS FOR VA

The approval by President Eisenhower of an authorized capacity of 125,000 beds for the Veterans Administration hospital system was announced by Sumner G. Whittier, Administrator of Veterans Affairs. Mr. Whittier said the new policy calls for: (1) Continuance of complete, high-quality hospital care for veterans with service-connected disabilities; (2) Within the 125,000 bed authorization, continued care for nonservice-connected veterans unable to defray the expense of hospitalization; (3) Authority for the Administrator to shift beds or hospitals, from one type use to another in keeping with medical progress.

With the new policy, Mr. Whittier added, the President reaffirmed his desire that all eligible veterans will continue to receive complete, high-quality hospital care.

The policy in no way changes the provisions for the care of veterans with service-connected disabilities. Veterans with nonservice-connected disabilities who are in need of hospitalization and unable to defray the cost, will be admitted within the authorized 125,000 beds.

Consolidation of authorized beds for VA hospitals brings together for the first time, authorizations contained in scores of documents dating back to the early 1920's. It deletes from government statistics a number of so-called "phantom" beds which were taken over from the military after World War II and in many cases now exist only on government records.

VA's Administrator, in the new policy, is granted full

authorization to shift beds or hospitals from one type use to another in keeping with advances in medical treatment and shifts in veteran population.

Specifically contained in the authority is permission to double the number of beds in use at the VA hospital in Dublin, Georgia, by adding 500 domiciliary beds. An additional 114 beds are being activated at the Lake City, Florida, hospital, making a total of 814 new beds approved for future use within the last year in that State.

Within the framework of the new program, VA will for the first time have a sound basis for long range planning in modernization and construction of new facilities.

Under the Presidential authorization, Mr. Whittier reaffirmed that the Veterans Administration will continue to provide immediate hospitalization for veterans seeking treatment of service-connected disabilities, and at the same time be able to provide even more beds than at present for non-service-connected cases, because of a leveling off in the service-connected demand.

VA ANNOUNCES SCIENTIFIC EXHIBIT AWARDS

Five scientific exhibits by Veterans Administration medical personnel won awards from the American Medical Association at the A.M.A.'s 108th Annual Meeting held in Atlantic City June 8-12.

A certificate of merit went to Dr. Gilbert Baum and Ivan Greenwood of the Bronx, N. Y., VA hospital and the National Institute of Health, for their exhibit on application of ultrasonic locating techniques to ophthalmology.

Awarded honorable mention were: Drs. Richard E. Peterson, Richard L. Lawton, and Donald V. Walz of the Iowa City VA hospital, for their exhibit on blood transfusions; Dr. S. William Simon of the Dayton, Ohio, VA center, for his exhibit on tests for oral drug utilization; Drs. Howard A. Buechner, Jordan Thompson, and Oscar Blitz of the New Orleans VA hospital, for their exhibit on bagassosis; and Drs. James S. Clarke, Paul K. McKissock, Ira Miller, and Kenneth Cruze, of the Los Angeles VA Center, for his exhibit on tests for oral drug utilization; after portacaval shunt.

About a seventh of the scientific exhibits at the meeting showed medical advances and findings made by VA personnel.

HALLUCINATIONS CREDITED TO BRAIN CHEMICAL

A brain-chemical theory of hallucination that may open new fields of understanding of the human mind has been developed at the Veterans Administration's Leech Farm Road Hospital in Pittsburgh. It is based on research findings by Dr. Amedeo S. Marrazzi, director of the VA's Research Laboratories in Neuro-psychiatry, which strongly suggest hallucinations occur because abnormal brain chemistry causes mixups in signals between parts of the brain in handling information. Since hallucination often is a part of severe mental illness, tracing its actual mechanism in the brain would for the first time give doctors a firm basis on which to build toward specific diagnosis and specific treatment of mental disease.

Dr. Marrazzi's research indicates that brain-produced substances called psychotogens stretch a chemical curtain between the association center and the visual center of the brain. With communication thus disrupted, the brain cannot draw on its stored experience or memory — the process by which a person decides what is real and what is unreal.

For example, when a mentally well person sees a cup he recognizes it because his brain has the ability to check with its stored experience of seeing other cups or somewhat similar containers in the past, Dr. Marrazzi explained. But if drugs or other chemicals inhibit or disconnect the association area of the brain from the primary visual or receiving area, there is nothing to tell the person whether his visual image is a cup or something quite different from reality, and he may hallucinate.

To test for variations in susceptibility to hallucinations and for the effect of disturbance in brain chemistry, Dr. Marrazzi is working with a group of volunteers made up of normal persons, mentally ill patients, and patients with physical damage in the visual association area of the brain. They are exposed to certain kinds of optical illusions before and after receiving tiny doses of drugs that are known to increase tendencies to see things different from reality.

The new work is an outgrowth of Dr. Marrazzi's previous research in which he found that excess of a naturally occurring chemical in the brain, serotonin, slows transmission of messages along the brain's nerve circuits too much and disrupts delay of thoughts.

Serotonin is a chemical relative of mescaline, a substance that can temporarily produce hallucinations and other symptoms of mental illness if given in sufficient dosage.

MEDICAL TECHNOLOGY JOBS OPEN

Many openings exist at Veterans Administration hospitals and outpatient clinics throughout the nation for the newly established position of medical technologist, the VA has announced. The jobs are supervisory, between the sub-professional and professional levels, and are in grades GS-7 through GS-11 with annual salaries of from $4,980 to $8,230. Successful completion of a full four-year course, including specified courses in chemistry, leading to a bachelor's degree from an accredited college or university is required.

The new positions offer opportunity for career advancement, medical research with eminent physicians and university research groups, and professional growth, VA said. Duties include a variety of responsible professional medical laboratory work as part of the hospital or clinic medical team. Participation in research is encouraged by the agency.

Application for appointment may be made to the Boards of Civil Service Examiners at VA hospitals in Albuquerque, N. Mex., the Bronx, N.Y., Cleveland, Ohio, Hines, Ill., Houston, Tex., Long Beach, Calif., Memphis, Tenn., Minneapolis, Minn., Portland, Ore., Richmond, Va., and West Haven, Conn.

Information on the jobs may be obtained at any VA quality of their experience and training.

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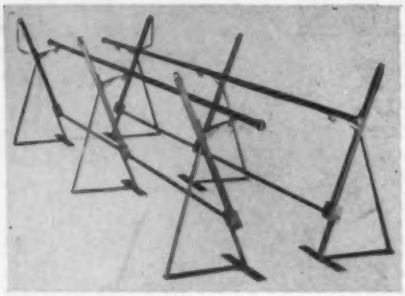

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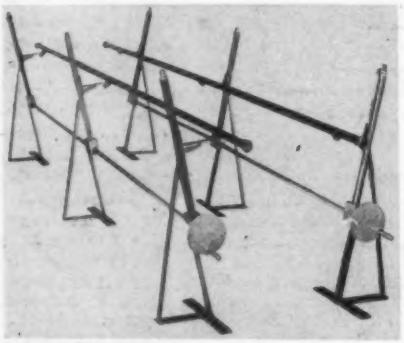

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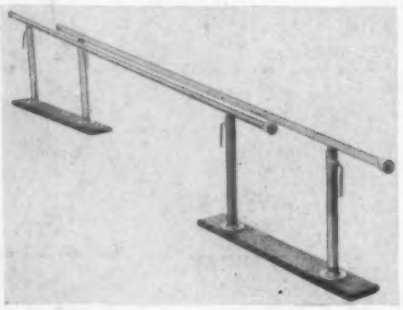

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